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EDITORIALS

PROGRESS IN ELECTRIC LIGHTING.

A generation ago electric lighting was a curiosity, seen by many but applied by few. Its many advantages were so marked and so obvious that it rapidly grew in favor and in diversity of application, and central stations for the supply of electric energy sprang up in every city and in many of the small towns. Today the building of whatever type that is constructed without provision for electric lighting is a curiosity, unless it be located in some remote place where electric service is not available.

Early efforts were devoted to securing sufficient quantity of light as economically as possible, with little attention to artistic, physiological, psychological or even engineering considerations, or to the conditions for good seeing. With continued improvements in power production and in the efficiency of light sources, the cost has been cut down until the furnishing of sufficient quantity of illumination no longer offers difficulty; reflectors, diffusers, shades and accessories have been developed to meet every need; and the designer of a lighting installation may now give his attention to those features which were at first neglected.

The rapid development in recent years in both the science and the art of illuminating engineering makes the study of such features fruitful, and it is worthy of note that such development has been largely parallel to and influenced by the development of the electrical industry. Really good lighting is not only available at the present day, but there is little excuse for not obtaining it. In the factory it is an element of efficient management; in the home it is an element of comfortable and hygienic living; in the street it is an element of safety. In all it pays. How it may be worked out is well discussed in this issue in special articles by Messrs. Clewell, Cravath and Millar. These discussions are supplemented by a generous section devoted to the illustration of up-to-date fixtures, and a study of all well indicates the tendencies of present-day practice.

A RECORD YEAR IN ELECTRICAL EXPORTS.

The official data for the foreign commerce of the United States during the fiscal year ended June 30, as reported in another portion of this issue, show that the electrical exports during that twelvemonth exceeded in value any similar preceding period. They make available a comparative study of electrical-export conditions between the first and second years of the war, since the last two fiscal years correspond closely to the two past years of the war. It will be recalled that on the opening of European hostilities there was a violent slump in business, both in the domestic and foreign trade, which was felt in practically all countries of the globe. The recovery from this violent depression was very slow and the fiscal year 1914-15 consequently showed a total of electrical exports which was about 21 per cent lower than that of the preceding fiscal year; the bulk of this falling off, of course, occurred during the first few months of the war. The recently closed fiscal year, corresponding to the second year of the war, shows a gain of some 53 per cent in electrical shipments over the first year. This is an evidence of the effect of gradual readjustment in international trade and also of the efforts made by the American electrical manufacturers, our Government and various commercial agencies to promote greater sale of American products abroad.

From the figures given on another page it is possible to make a detailed comparison of the last two fiscal years, from which it is evident that the year just closed has shown a marked increase in the value of all classes of electrical exports except two, namely, electric generators and arc lamps. Of these, the former have been showing a gradual falling off since 1913, and arc lamps have also been decreasing, doubtless in the same way as is true in this country, since the use of the tungsten lamp has become so very general as to largely replace almost all other illuminants. Tungsten lamps, by the way, show the most radical increase in the electrical exports. In the last fiscal year the number of these lamps exported was nearly three times that in the preceding year; these shipments of lamps now are approaching in number nearly one million monthly and are steadily growing, showing that other countries are experiencing the same tendency to use them in preference to other illuminants. In aggregate value the largest increase in electrical shipments during the last fiscal year over the preceding one is shown in the increase of nearly $6,000,000 made in the miscellaneous or "all other" division. This large unclassified group approximates very nearly one-half of the entire electrical exports, showing the desirability, if possible, of taking out from it some of the most important items and classifying them separately.

Although the electrical totals for the past fiscal year have established a new record, it is only about 13 per cent over that of the preceding best fiscal year (1912-13) and only about 7 per cent over the calendar year 1913, which had the previous record total for any twelve months. Despite this high value, it is doubtful whether the total volume of the export business, that is, the actual quantities of electrical products shipped, was greater during the last fiscal year than during the years just preceding the war. This is on account of the marked in-

crease in the price of copper wire, in particular, and also of other materials that go into the manufacture of electrical products. This accounts largely for the increased total value of insulated wire and cable exported. To what extent it has increased the cost of other products is not so clear. In the case of incandescent lamps there has been an actual decrease in the cost per lamp. In the case of electric fans the cost per unit exported has remained practically constant throughout the last three fiscal years, averaging a little over $13. In the case of generators, motors, transformers, etc., in which the cost of wire and steel enters more largely in the total cost, this increase is easily explained.

In spite of the uncertainty as to whether the actual volume of the electrical foreign trade has materially increased over that which prevailed prior to the war, it is interesting to note that the total of electrical shipments is increasing almost every month. This is a healthy sign and indicates that electrical manufacturers are taking the increased interest in foreign trade that there has been so much talk of, and which it was expected would be even greater than apparently has been the case.

PENALTIES FOR OUTAGES IN STREET LIGHTING.

When a municipality enters into a contract with an electric lighting company for the lighting of streets or other public places, it is common to stipulate that when individual lamps for any reason fail to operate for a specified period, a deduction from payment shall be made for the time lost and in addition a penalty shall be imposed upon the lighting company. From the standpoint of the municipality such a penalty seems reasonable, since when a lamp is contracted for and the lamp fails to burn, the loss to the public is considerably more than the saving in cost of service on a proportional basis. It is consequently claimed that a deduction for it should be higher than the amount saved by the lack of operation, and when such a penalty is imposed the city officials and the public naturally feel that the contracting company will exert every endeavor to re-establish the service as promptly as possible. Many lighting companies have accepted such provisions in street-lighting contracts without finding them at all onerous in practice.

There are certain conditions, however, where such a provision may work undue hardship upon the company and from causes entirely beyond its control. Such conditions may arise from storms, fires, floods, riots and possibly even from conditions for which the city is itself responsible. It would seem only just, therefore, to insert a provision in the contract which would relieve the company under such circumstances from suffering any more than a pro-rata deduction from the rate of payment specified in the contract.

In some cities a certain specified range of tolerance is permitted to the contracting company and no penalties are applied unless the number of outages should exceed this limit. In Cleveland this tolerance has been placed at two per cent as measured in lamp-hours. If the number of outages exceeds this limit a penalty is applied. In other cities one day is permitted to make repairs or replacements after an outage occurs before the penalty is applied. It is well to provide that the police or other city officials shall give notice of outages and that penalties or time limits shall only be applied from the date of such notice, as otherwise the lighting company might remain in ignorance of the conditions which it is supposed to correct.

Outages are, of course, most likely to occur in large numbers at a time interval, after a new system is placed in operation, represented by the average life of the lamp. This applies especially to the incandescent type of lamp. Unless a close watch is kept upon the lamps at this period, outages will follow each other so closely as to become unusually troublesome. A scheme which may obviate some of the difficulty encountered at such times is to replace lamps in large groups, whether burned out or not, and to utilize the remaining life in the unbroken lamps by installing them in a restricted district close to the operating station. In this way full advantage may be taken of lamps which have more than the normal life without excessive trouble to the operating force and without excessive penalties for outages which require greater time to correct.

In the model form of specification drawn up by a committee of the Ohio Electric Light Association, it is provided that the police shall make immediate reports to the lighting company of any outages which are noted. If these outages occur before midnight the company is allowed two hours in which to re-establish the service. If the outages are reported after midnight the contractor is given the following day for replacement. If the service is not re-established within these intervals a deduction from the contract price is made, equal to twice the amount represented by the full time the lamp was reported out of service.

SPECIAL PARK LIGHTING.

Opportunities for special park lighting of a desirable long-hour type are to be found in several applications realized or desirable outside the routine and pathway illumination. On an eastern watercourse much frequented by canoeists from early spring to late fall, an interesting example of the benefits of low-powered lighting appears at a low-arched bridge. Canoe traffic up and down the river is required to pass through adjacent arches on the "one-way street" plan, and consequently the installation of low-powered pilot lights over one arch on the upstream side and over another on the downstream side of the bridge unquestionably saves many a collision if no more. The waterway is naturally rather dimly illuminated, and the pilot lights are hooded and equipped with appropriate reflectors merely bringing the prop-

er arch to steer through into relief, the whole arrangement being a "safety feature" of the river literally invaluable in terms of the cost of its maintenance.

Another opportunity worth considering in this connection by central-station lighting men searching for new loads of long-hour type would be the illumination of life preservers, ladders and grappling poles placed at occasional intervals along fresh watercourses frequented by pleasure craft. A big field also exists in connection with the sign lighting of such courses and shores, and the beauty of electrical service is that it enables the utmost convenience to be served without the least objection from the standpoint of landscape gardening.

WIRING AND LIGHTING IN FOUNDRIES.

Modern foundry buildings are built very largely of galvanized iron or steel. A good building can be erected of corrugated sheet iron on a steel frame for less money than one of brick, concrete, or other suitable material. Open wiring in such buildings should not be considered, as the frame is grounded, dust is prevalent and chances of damage to the wires are big. A conduit installation is the only thing to use under such circumstances. For power purposes induction motors are likely to prove most satisfactory. On account of the dust, commutator motors are difficult to keep in good condition, unless inclosed.

General illumination is urgently needed in the foundry. Many accidents have occured from inadequate illumination and due to excessive contrasts between well lighted and dimly lighted portions. Local illumination, moreover, is not easily supplied except at benches and similar locations. Deep shadows should be avoided, and light should fall upon the molds from more than one direction. A single row of lamps, as found in some foundries, is pretty sure to prove inadequate and unsatisfactory.

In choosing light intensities and lamp sizes, it must be remembered that, owing to excessive dirt, deterioration is rapid, and average values will be much lower than initial values. Provision should be made for frequent cleaning of reflectors and lamps, but even then the decline between cleaning days will be marked. Initial values should consequently be much higher than the working values desired. At least two foot-candles should be provided for all molding, and for small work three foot-candles or higher may be found advantageous. For pouring and around the cupola one or two foot-candles is sufficient. For core-making and pattern-making higher intensities are desirable, and five foot-candles is not too much.

Owing to the presence of dust, steam and fumes, the penetrating qualities of yellow-flame arc and mercury-vapor lamps give them advantages for foundry work. The gas-filled tungsten lamp can economically be used, however, in sufficient wattage, and freedom from other attention than cleaning tends to compensate for any disadvantage in quality. With units of high candlepower it is especially necessary to provide high mounting in order to avoid glare. In the foundry this requirement is usually anticipated by the fact that head room is required for cranes, and lamps must be mounted near the roof, a condition which is favorable for uniform general illumination.

RATES FOR POWER AND LIGHTING.

The trend of court decisions and commission rulings upon the reasonableness of rates for electric service is towards basing charges upon the cost of service, although there are a number of notable exceptions to this general rule. Where differences in cost of service can be shown differences in rates are admittedly justified. The practice of dividing customers into classes according to their conditions of use and of arranging schedules of rates according to such classifications is thoroughly ingrained in general practice and is well grounded. The cost of service varies with hours of use, with the load-factor, the power-factor, the diversity of the group demands, etc., and classifications based upon the differences in such conditions are logical and reasonable. In practice, however, on account of difficulties in determining these factors, it is more convenient to classify customers according to the purpose for which electric energy is used, since like purposes connote similar conditions of use. When questions arise as to the exact classification of a particular customer, a decision can most equitably be made by keeping in mind these distinctions.

A decision of the Public Service Commission, First District, of New York, reported in the last issue, consequently invites criticism, since it appears to be made upon the basis of a literal interpretation of classifications rather than in the spirit of equity, keeping in mind the principles underlying the classification of customers. According to this decision, a customer who supplies lighting equipment through a motor-generator or rotary converter is entitled to the same rate as power customers, since the energy received from the central station is directly applied to driving a motor. The point of view here involved seems to ignore entirely the purpose for which energy is applied and the consequent conditions of use which affect the cost of supply. This decision is an inducement to every large lighting customer to interpose a motor-generator between the supply line and his load. Economically this is pure waste of investment, but if it results in a lower rate per kilowatt-hour, it will surely be done by consumers whose load is large enough to justify it, while the small consumer will continue to pay the higher rate and thus suffer a discrimination.

Decisions in other jurisdictions upon this same question have more often taken the opposite ground and many rulings have been made that such a load is not entitled to a power rate, but should pay upon the same basis as other lighting consumers. This viewpoint seems more logical, since the interposition of a motor-generator set does not change the conditions as to demand or consumption of the load involved.

Happenings in the Industry

Committee on Wiring of N. E. L. A. to Meet in New York on September 19—Southern Business Interests Work for Government Hydraulic Plant—Iron and Steel Electrical Engineers, Convention Program—Arc-Lamp Development—Coast Representative for S. E. D.—Electrical Exports Continue to Show Marked Gains

N. E. L. A. Committee on Wiring to Meet September 19.

The Committee on Wiring of the National Electric Light Association desires to consider other systems of wiring in addition to the concentric, which hold forth any promise of increasing the safety without increasing the cost, or of decreasing the cost without decreasing the safety, according to R. S. Hale, chairman. At least two such systems have been called to the attention of the committee, and at its meeting on September 19 the committee will consider what it can do and what the central-station industry can do towards having these systems tried out, and then approved if they shall be found satisfactory.

The committee also desires to consider any other methods, and would be glad if those who are interested in such systems or who have knowledge of them would submit the data that would be necessary for the committee to take further action.

Any communications may be addressed to the chairman either at his office, 39 Boylston Street, Boston, or the N. E. L. A. headquarters in New York.

Effort Made to Have Government Hydroelectric Plant Located on Tennessee River.

An active campaign has been begun by business interests in the South to bring about the location of the hydroelectric and nitrate plant, for which Congress recently appropriated $20,000,000, at Muscle Shoals, in northern Alabama on the Tennessee River. Especial interest attaches to this site, as a board of army engineers recommended, in 1914, that the Government undertake the development of the power available here in co-operation with the Muscle Shoals Hydroelectric Development Company, a subsidiary of the Alabama Power Company, a scheme being proposed by which 680,000 horsepower would be developed by means of storage waters owned by this company, together with the improvement of navigation facilities on the Tennessee River. The present measure does not permit of the co-operative plan.

The Nashville Section of the Engineering Association of the South has been assigned the task of preparing engineering data to be presented to the Government. The work is being done by a committee of which John Howe Payton, president of the Nashville, Chattanooga & St. Louis Railway, and a civil engineer, is chairman, with W. G. Waldo, of Vanderbilt University, as executive secretary. Harry Badger, superintendent of power of the Nashville Railway & Light Company, is a member, assisting in electrical engineering investigations.

The President of the United States has turned over the consideration of the matter to the Secretary of War, who has asked the Academy of Science to aid in determining which method of electrical fixation of nitrogen from air is the most practicable for the purpose of this plant, which is to manufacture munitions particularly in case of war, and nitrogenous fertilizers in time of peace. A special board of the ordnance bureau of the War Department has recommended that the site chosen for this plant be between the Rocky and the Allegheny Mountains and under no conditions to be within 200 miles of a seaboard or border. These conditions have narrowed down the choice of sites.

In all previous investigations of this subject, two other sites have been prominently mentioned. These are the Keokuk dam on the Mississippi and Priest Rapids on the Columbia River. The former, however, is now eliminated by reason of the fact that all power is being sold at a price higher than that at which nitrogen fixation is feasible and that there is a big market awaiting future development. The considerations of the ordnance bureau have caused the Columbia River site to be dropped. Many sites throughout the country are now being proposed by various sections.

The engineers of the United States Army have made investigations at Muscle Shoals with a view to combined power and navigation improvement since 1909 and have, under direction of Congress, made diamond-drill borings to determine the foundation for the dams. These were wholly satisfactory, the bed of the river being of hard limestone and flint, proving solid to a great depth and not subject to scour. Plans in considerable detail are also ready.

The Tennessee River at this point is about 1.25 miles wide and its bed drops 135 feet in 32 miles. A minimum constant discharge of 7,200 second-feet is available, providing for about 100,000 horsepower. This minimum is reached at comparatively rare intervals. For an average of 359.5 days a year, on the records of 41 years, a discharge of 10,000 second-feet is available. There is a secondary power site available, capable of producing 117,000 horsepower additional for ten months, making a total power for ten months a year of 217,000 horsepower.

The tentative plans prepared by the special board provide for the construction of two concrete gravity dams, with a power-house at each. One is to be 100 feet high, with a 95-foot head, and the other is to be 50 feet in height, with a 45-foot head. These dams would wipe out the shoals as an impediment to navigation and would provide continuous boating stage from Knoxville to Paducah, Ky., where the Tennessee flows into the Ohio River. This would open up both a large agricultural and mineral region, tapping the cotton section and the aluminum, iron and copper developments of Eastern Tennessee.

Program of Iron and Steel Electrical Engineers' Convention.

A program of very interesting papers has been arranged for the tenth annual convention of the Association of Iron and Steel Electrical Engineers which is to be held at the Hotel LaSalle, Chicago, September 18 to 22.

There will be a business session for members only on Monday morning and at the afternoon session the following papers will be presented: "The Value of Records to an Operating Engineer," by Ray S. Huey. "Cost Versus Upkeep of Direct-Current Motors," by A. M. MacCutcheon. Tuesday morning there will be a discussion of the subject of "Central-Station Power for Steel Mills" and a paper entitled, "Design of Structures for Steel Mills," by Charles A. Randorf. In the afternoon visits will be made to various points of interest including the power stations of the Commonwealth Edison Company.

Wednesday there will be joint sessions with the American Institute of Electrical Engineers and the following papers will be presented: "Underground Distribution Systems," by George J. Newton; "The Unaflow Engine," by

W. Trinks; "Steel Conductors for Transmission Lines," by H. B. Dwight; "The Advantages of Modern Types of Direct-Current Machines," by David Hall. The annual banquet and ball will be held at 7 p. m. on Wednesday and ladies are cordially invited.

Papers to be presented at the sessions on Thursday include, "Mechanical and Electrical Operation of the Heroult Electric Arc Furnace," by George W. Richardson; "Operating Characteristics of an Electric Reversing Blooming Mill," by E. S. Jefferies; "Control of Direct-Current and Alternating-Current Motors as Applied to Cranes," by Paul Caldwell; and "Portable Electric Tools as Applied to the Iron and Steel Industry," by A. M. Anderson.

ARC LAMP DEVELOPMENT DURING THE YEAR.

A Review of Conditions Prepared by the Westinghouse Electric & Manufacturing Company.

Since the advent of the Mazda C lamp for industrial lighting purposes the increase in the volume of business for arc lamps has not been unusual. While the sales of arc lamps for street lighting have been good they have not been abnormal, as more and more Mazda lamps are being utilized for this purpose too.

The industrial lighting business, in which the greatest expansion has occurred, has been cared for almost exclusively by the Mazda lamp, due to lower installation cost. A large increase in the number of such installations on series circuits, replacing inclosed carbon arc lamps, has been one of the most noticeable features. This is directly attributable to the fact that fixtures for the operation of 400, 600, and 1,000-candlepower, 15 and 20-ampere Mazda C lamps, can be substituted for the inclosed carbon arc lamp on existing arc circuits without it being necessary to change any of the other equipment. Such a lamp will give over three times the amount of light with the same power consumption. Furthermore, by a slight modification (omitting autotransformer and putting in a multiple socket) the same fixture can be used for yard lighting or outdoor display lighting, as it is particularly designed to protect the lamp in exposed locations.

The flame carbon arc lamp, within the past year, has become practically independent of the foreign manufacturers of carbons, excellent results having been obtained with domestic carbons. This points to a retention and noticeable expansion of this business in the near future. For, as the relatively high efficiency of large candlepower units becomes better appreciated, their use for the lighting of large areas will undoubtedly become very prominent.

Metallic-flame arc lamps have been improved during the past year, particularly in the line of greater simplicity and reliability of operation, though their maintenance cost in comparison to the illumination obtained had already left little to be desired from a unit of this size.

Coast Representative Appointed for the Society for Electrical Development.

Arthur H. Halloran, vice-president and managing editor, *Journal of Electricity, Power and Gas*, San Francisco, has been appointed Pacific Coast representative of the Society for Electrical Development. Mr. Halloran's headquarters will be in the Crossley Building, San Francisco, Cal.

The association membership on the coast is quite enthusiastic and a special coast representative will undoubtedly still further increase their interest in society activities.

Mr. Halloran will represent the society in the states of California, Arizona, Nevada, Utah, Idaho, Oregon and Washington.

Big plans are being made by western cities for the America's Electrical Week sales-celebration.

Electrical Exports for June and for the Fiscal Year 1915-1916.

The electrical exports for last June, as shown by the official figures taken from the monthly summary of the foreign commerce of the United States, recently issued by the Bureau of Foreign and Domestic Commerce, Washington, D. C., exceeded in value those of June a year ago by nearly 54 per cent, though showing a decrease of some 8 per cent from the record total of May, 1916.

An imperfect idea of the volume of the electrical export trade is given from the only four classes of electrical shipments for which the government figures report numbers of articles exported. For June these compare as follows:

Articles	Numbers Exported in June, 1916	June, 1915.
Electric fans	1,977	3,781
Arc lamps	16	137
Carbon-filament lamps	35,541	74,689
Metal-filament lamps	802,640	385,773

The following table gives the detailed figures for last June and for the corresponding month a year ago:

Articles	June, 1916	June, 1915
Batteries	$ 159,876	$113,950
Dynamos or generators	145,965	191,464
Fans	24,831	48,106
Insulated wire and cable	290,151	253,247
Interior wiring supplies, etc. (including fixtures)	36,835	70,915
Lamps—		
Arc	156	1,826
Carbon-filament	4,188	11,432
Metal-filament	133,683	78,536
Meters and other measuring instruments	72,540	41,214
Motors	321,147	283,923
Telegraph instruments (including wireless apparatus)	2,564	1,522
Telephones	183,965	44,342
Transformers	55,847	70,543
All other	1,712,396	836,061
Total	$3,150,144	$2,047,081

The following table gives the monthly totals for the 12 months of the last fiscal year:

Month and Year	Electrical Exports
July, 1915	$2,147,307
August, 1915	1,806,292
September, 1915	2,263,291
October, 1915	2,145,594
November, 1915	2,774,847
December, 1915	2,177,338
January, 1916	2,320,822
February, 1916	2,942,611
March, 1916	2,884,875
April, 1916	2,630,169
May, 1916	3,437,609
June, 1916	3,150,144

The following table gives a detailed comparison of the last two fiscal years ended June 30 in each case:

Articles	Electrical Exports in 1914-1915	1915-1916
Batteries	$ 967,146	$ 1,569,836
Dynamos or generators	2,013,130	1,468,961
Fans	258,309	356,729
Insulated wire and cable	1,911,850	3,157,239
Interior wiring supplies, etc. (including fixtures	753,351	818,985
Lamps—		
Arc	30,984	18,693
Carbon-filament	101,923	144,872
Metal-filament	473,149	1,282,039
Meters and other measuring instruments	440,916	776,381
Motors	2,848,743	4,218,974
Telegraph instruments (including wireless apparatus)	76,271	148,536
Telephones	1,149,361	1,329,346
Transformers	624,483	993,193
All other	8,152,141	13,970,236

A comparison of the electrical totals for the last four fiscal years is given below, the year 1912-1913 having the preceding highest total.

Fiscal Year	Electrical Exports
1912-1913	$26,772,816
1913-1914	25,060,844
1914-1915	19,771,757
1915-1916	30,254,020

The foregoing figures do not include electric locomotives, which are listed separately. During the fiscal year 1915-1916 there were shipped 64 such locomotives, valued at $454,544; in 1914-1915, these numbers were 43 and $324,478; in 1913-1914, they were 48 and $437,452, respectively.

ARC LAMPS FOR EXTERIOR LIGHTING.

A Statement on Present Conditions Prepared by the General Electric Company.

Recent developments in the arc lamp have been toward increased efficiency in electrodes, more compact arrangement of mechanism and a decided tendency toward ornamentation.

Fig. 1 is the eight-panel type of globe for the ornamental luminous arc consisting of a cast-iron frame in which are placed sections of diffusing glass resting upon felt cushions and held in place by spring clips. This globe has a large area of glass exposed which allows ample light to escape. Thus we obtain the ornamental effect from the ribs without undue loss of light absorbed by them. The globe cost is reduced to a minimum as the replacement of one section of glass is much less than a globe of the same diameter.

Fig. 1.—Ornamental Luminous Arc With Sectional Globe.

The pendant-type luminous arc lamp can now be equipped with a diffusing globe which permits more upward light to be used. The light center being well below the top edge of the globe allows a certain amount of the light rays, heretofore lost in the pendant type of lamp, to pass above the horizontal and tends to eliminate the sharp shadows on adjacent buildings.

This upward light is not as effective as upward rays from the ornamental type of lamp, but it illuminates the building front above the horizontal, gradually decreasing in intensity. It is well suited to illuminate congested districts where local conditions will not permit installing the ornamental type. Its outward appearance is pleasing as shown in Fig. 2.

Records show that the increase in efficiency of lighting units has not tended to decrease the amount of energy used. The demand continues for large size units, and as the luminous lamp is one of the most efficient street-lighting units now in general use, a continuation of its popularity is assured.

Two striking examples of this type exist in Salt Lake City and San Francisco, where there are being installed in the business section, units consisting of three 500-watt luminous lamps on each post, (Fig. 3), and each lamp giving an initial candlepower of approximately 1,500.

The pendant type of luminous arc lamp equipped with a

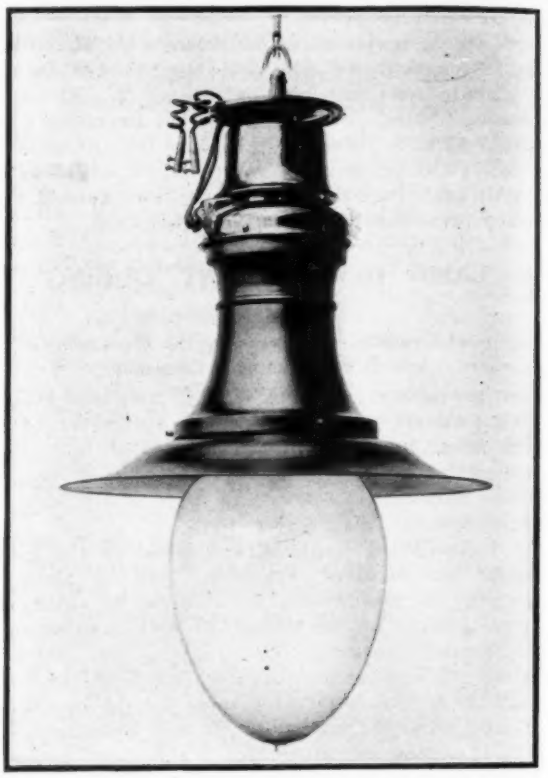

Fig. 2.—Direct-Current Series Luminous Arc.

clear globe and prismatic refractor has proven to be all that is claimed by its adherents. As is now universally known, this device re-directs the illuminating rays from the arc to the angle most suited for street lighting.

From the foregoing it would seem that the higher-current luminous arc continues to hold front place for the lighting of business areas; that the tendency is toward ornamentation of design insuring a pleasing effect by day as well as by night; that a further increase in electrode efficiency is to be expected.

Fig. 3.—Model of Luminous Arc Lamp and Bracket in San Francisco.

Modern Practice in Residence Lighting

Concrete Recommendations for the Lighting of Residences With Special Reference to the Selection of Fixtures Suited to the Requirements of the Average Interior

By James R. Cravath
Consulting Illuminating Engineer

ALTHOUGH the principles which should apply in the lighting of residences have been gone over many times, the changes in the electric lighting art which are constantly going on necessitate changes in the methods of applying these principles and remove old limitations so that it is well to have a "round-up" occasionally to determine where the most advanced and approved practice lies.

In attempting to point out the good and the bad in modern residence-lighting tendencies we must necessarily deal with many different classes of residences from the three-room cottage or apartment up to residences of the highest class. The very expensive houses are so small a percentage of the whole that this article will be confined mainly to homes costing from $800 to $10,000, leaving the mansions of the millionaire for the special treatment which they usually require.

The principally used rooms of the house will be taken up one by one and the general types of lighting equipment suggested for each, beginning with the most inexpensive houses and going up by steps.

Before beginning on the various kinds of rooms specifically it may be remarked that in general in the cheaper classes of houses the tendency has been to spend too much on cheap clap-trap fixtures for locations where very much simpler fixtures or no fixtures at all would be better, so as to leave more money available for additional switch outlets or proper glassware equipment. The introduction of the tungsten lamp about eight years ago brought such an increase in the amount of light available for a given expenditure that most of the reasons for the old-fashioned multiple-arm low-hanging chandelier (Fig. 1) immediately dropped out of existence, leaving but conservatism and the desire of the fixture maker to reduce his old stock to keep this antiquated device in use. Nevertheless, many home owners, electrical supply dealers and central-station men are not awake to this fact even yet, as is evident by the number of such fixtures displayed and sold and, I regret to say, even selected for special cheap wiring offers by some central stations.

Living Room.

For the living room of the three or four-room cottage the plain drop cord and bare lamp or the cheap chandelier just referred to have been altogether too common. A better arrangement for such a room is a ceiling socket or ceiling fixture at the center equipped with a lamp of 25 to 60 watts and a reflector giving an extensive type of distribution, such reflector being preferably one of the dense opal types. Fig. 2 shows such a unit. If possible, this should be controlled by a wall switch, but if cost is to be cut to the limit, a socket with pull-chain attachment can be used. Experience has demonstrated, however, that these pull switches are likely to be subjected to such rough usage that wherever possible the wall switch should be used. This plan of direct lighting should only be used where expense must be cut to the limit. However, the bad effects of glare from a partially exposed light source mounted high are somewhat mitigated in a small room by the fact that persons are not so likely to sit facing the source. The simplest fixtures for direct and semi-direct lighting are not very expensive and are well within the reach of the small home owner. A typical one is shown in Fig. 3.

In a living room, of all places, protection of the eyes from glare is important. This means that either the lighting must be limited to that obtained from thoroughly shaded bracket, table or desk lamps (Fig. 4), giving only localized light, or the lighting must be largely indirect with the sources almost completely concealed (Fig. 5). For a great many living rooms both methods in combination are desirable, namely, general lighting by indirect or semi-direct methods and localized lighting from a well shaded source of light for high intensity at some one point. The special need for avoiding the glare of bright light sources in the living room is that this room is occupied many hours per year and frequently the occupants are seated facing the lighting fixtures, whatever they may be. With any kind of direct lighting fixture hung in the middle of the room visitors are almost sure to get glare from the lamp.

Semi-direct lighting for living rooms using bowls of translucent glass has been popular for some time and, in so far as common practice in this respect represents a reduction in the amount of glare, this tendency is to be commended. However, this semi-direct lighting has been too frequently carried out with glass bowls (Fig. 6) of such light density that altogether too large a percentage of the lighting is direct through the bowl and the brightness of the bowl is over 250 millilamberts, which is too great. Only the most dense glass bowls at present on the market should be employed for living-room semi-direct lighting.

It is, of course, possible to provide sufficient indirect or semi-direct illumination to fulfill all of the various requirements in a living room, but, since these requirements are so varied, it is usually most practicable to provide for the highest intensities by localized lighting. The living room is commonly used for visiting, for reading of books and music, for writing and frequently also for sewing or embroidering. In a room 14 to 16 feet square with light ceiling and walls of a medium tint between the darkest and the lightest in common use, ample indirect light for general illumination can be obtained with a lamp of 60 to 100 watts. With a 100-watt lamp and a large percentage of the light indirect from the ceiling there will be plenty of light for reading almost anywhere in the room for the majority of young people. There will not be sufficient reading light for some people above forty years of age, and especially for very old people. For sewing on dark goods or anything requiring very high intensity of illumination a larger wattage would have to be used. One feasible plan is to increase the general illumination by the use of 300 to 500 watts in the indirect or semi-direct fixture. While

there is nothing to be said against the resultant large amount of general illumination from the hygienic or artistic standpoint (provided it is largely indirect) as it is considerably less than that to which we are accustomed with daylight, it is a more expensive method of lighting than many householders think they can afford. The obvious

Fig. 1.—A Relic of Carbon-Lamp Days.

These low-hanging, two, three and four-arm fixtures are not suited to present tungsten-lamp conditions for the living room. Fig. 2 is neater, less expensive and less glaring.

and usual method of taking care of this situation is to provide localized lighting. This can be done by a well shaded bracket or table lamp or by a shaded lamp on a drop cord, or by a properly shaded direct lamp on the central fixture. Whatever method is used for the direct localized illumination of course should have an opaque or nearly opaque shade and should have the lamp far enough up in the shade so that the source of light is never exposed to the eyes of the occupants of the room. If the reflector for the direct lighting is on the central fixture or above the heads of the occupants, then glare can only be avoided by having the reflector deep enough so that the direct light from the lamp is confined to a cone having an angle of about 25 degrees from the vertical. When this is done the reflectors will protect the eyes of those seated back in the room away from and facing the fixture while those reading or sewing underneath the fixture are protected from glare by their eyebrows. One simple design for combining direct

Fig. 2.—The Best "Fixture" for the Smallest Homes.

For most of the rooms of the smallest homes the simple ceiling fixture or socket with deep bowl reflector is better than a display of unnecessary brasswork. The money saved on this as compared to Fig. 1 can well be spent on wall switches and better reflectors.

and indirect lighting in one fixture has been made by the writer and other means of accomplishing the same end will suggest themselves.

If the architectural style of the living room is not such as to permit of fixtures hung from the ceiling and the lighting must be from wall outlets, one still has the choice between well shaded localized lighting and general lighting by indirect methods, or a combination of the two. If the architectural style of the room calls for a dark ceiling and a generally subdued and gloomy effect, the only treatment to harmonize with this plan is to provide bracket and table lamps well shaded with ornamental glassware or silk and allowing sufficient illumination under and near them for reading purposes. It is practically impossible to light such an interior up to modern ideas of adequate lighting intensity, and at the same time preserve the medieval semi-darkness sought for by the architect. With modern high-efficiency lamps it is quite possible, but usually not very feasible, to put in enough indirect bracket and cove lighting in such a room to bring the illumination up to a fairly good intensity without causing an intolerable glare. If, in such an interior, cost of operation is a minor consideration, one need not be afraid of the wattage required; but of course in lighting a room in this way some of the fundamental ideas of the architectural plan are ignored. It is therefore for the owner to choose between the consistent carrying out of ancient and disagreeable conditions of artificial lighting or some inconsistencies and more light. While on this subject, it may be noted that an attempt

Fig. 3.—Cheap and Good Indirect or Semi-Direct Type of Fixture.

A decided step better than the simplest (Fig. 2) is to cut down the glare by an upturned reflector, either opaque or very dense. Costs no more than Fig. 1 and gives illumination of the best diffused, non-glaring quality.

to light a room with dark ceilings and walls by direct methods necessarily involves more objectionable glare than direct lighting of a light-colored room.

Dining Room.

There are two general plans of dining-room lighting which have always found the most general favor and both of which are correct, if properly carried out. One of these plans is that of localized lighting with a shaded light source directly over the dining-room table. This is, in a sense, a form of indirect light, for the general illumination of the room may then be largely from the white tablecloth. Then there is the other plan of providing general illumination for the whole room and incidentally for the table. As to which of these methods is the best depends altogether on the taste of the owner and the general character of the room. To many minds there is something cozy about the localized lighting over the table only. We will consider proper and improper methods of carrying out both the general and the localized lighting in various classes of dining rooms.

Localized lighting can be attractively provided in the most inexpensive homes over the dining table by the use of a silk drop cord and with an opal or prismatic reflector giving an extensive type of distribution, the reflector to be covered and rendered more opaque with an ornamental

cloth or paper covering by the owner (see Fig. 7). Of course, the important thing with this arrangement is the height of the lamp above the table so that the reflector really shades the eyes of those seated at the table, and a sufficient density of the reflector in case the cloth covering is not very thick or is not used at all. The reflector should preferably be of one of the dense opals rather than one of the light opals or phosphate glasses. As to the exact height of the lamp, no general rule can be made other than that already given of shading the eyes, because table sizes and positions of lamp filaments in reflectors vary somewhat, but this lamp-filament height will usually be from five feet to five feet six inches above the floor.

For the more expensive classes of dining rooms the localized lighting can be nicely obtained from chain or rod pendent fixtures with art or tinted glass dome. As the popularity of the art-glass dome for dining-room lighting seems to be somewhat on the wane, some owners will prefer shower fixtures with silk shades over rather dense opal or prismatic reflectors, such as the fixture shown in Fig. 8. Or, if one-piece reflectors in glass of proper tint are selected of sufficient depth to answer the requirements as to shielding the lamp filament, an equally good and up-to-date effect can be obtained. Right here is a good place to say something about the common misuse of the shower fixture, both in dining rooms and living rooms at the

Fig. 4.—For Localized Light From Brackets.

The densely shaded bracket is sometimes the best method for localized lighting in living rooms, and in some rooms must serve for the entire lighting.

present time. These fixtures are used with all kinds of inadequate shading. Either the shades are not deep enough (Fig. 9) or, if deep enough, are not dense enough. It is the exception rather than the rule to see them properly used, and they are usually atrocious sources of glare.

For lighting a dining room by general illumination, the most inexpensive plan is that suggested for the least expensive living room. For more expensive dining rooms the plans suggested in connection with the more expensive living rooms can be used. For the general lighting of a dining room, indirect methods should prevail for the same reasons as in the living room. This may be either from coves or brackets or from a central fixture.

One very practical consideration in connection with dining-table lighting is that of providing some place to plug in a percolator, chafing dish or toaster for use on the table. Although there are many good reasons for plugging these into a floor receptacle under the middle of the table so as to keep the space above the table free from cords, the writer has never found this plan popular with clients on account of the necessity of having a hole in the rug. Putting these cords across the floor to a baseboard receptacle is bad practice. Therefore in many cases about the only thing left to do is to provide a place on the fixture above the table to plug in these devices. With a shower type of fixture for localized lighting of a table, this heating service can be obtained through one of the sockets of the shower. With indirect or semi-direct lighting from a central fixture over the table, a good plan for taking care of this is that of having three or four pendent sockets along the edges of the bowl, as shown in Fig. 10. Of course, no lamp should ever be placed in these sockets and they should be wired for 660 watts each for heating serv-

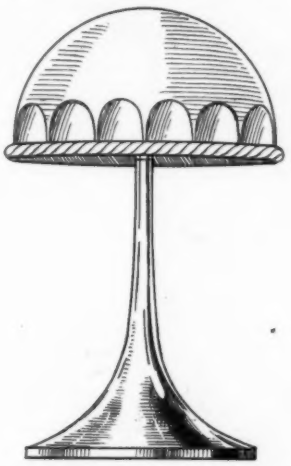

Fig. 5.—An Ever-Popular Localized Light.

The table lamp, if properly shaded, is a good method of localized lighting for several people. For one or two a concentrating, nearly opaque reflector over the heads is more effective and may be made equally artistic.

ice. Any kind of ornamental husk or covering can be used over the sockets, if desired. Of course, such sockets may be equipped with shades as a means of improving the looks of the fixture, but this is likely simply to add to the tendency of the ignorant user to put lamps in these sockets. In fact, if the fixture is to be made as foolproof as possible, do not put on sockets which will take a lamp base at all, but put on some of the receptacles taking one of the standard knife-blade plugs.

The type of fixture just described with a large bowl for semi-direct lighting and pendent sockets around the edge is extensively used or misused by unthinking builders, contractors, and fixture dealers, by putting exposed lamps in the outer sockets. What consistency is there in carefully concealing lamps in an indirect or semi-direct lighting

Fig. 6.—Indirect or Dense Semi-Direct Bowl.

This method, where conditions permit, is pre-eminently the most hygienic and comfortable for living rooms and also has material advantages for dining and bed rooms.

bowl and then hanging around the edge of the bowl a lot of exposed lamp filaments?

Kitchen.

The kitchen is too likely to get what is left over after the lighting of the rest of the house is provided for. A

more consistent way would be to begin with the kitchen, as it is the place where so much work is done and good light for it is so important.

For a small kitchen in an inexpensive house, general lighting by means of a single lamp in an extensive type of

Fig. 7.—For the Humblest Dining Rooms.

Cloth or paper shades on a simple silk-drop-cord lamp make a pretty dining-table light for the small home.

opal reflector placed at the ceiling and controlled by a wall switch answers the purpose well. Of course, with this arrangement those working in the kitchen around the walls at the sink and stove are more or less in their own light.

An improvement on the foregoing plan for more expensive houses is to put one lamp with an opal glass reflector over the sink or wherever the dishes are to be washed, the lamp to be about eight feet above the floor. This will give general lighting with a maximum under the lamp where it will be most needed. Then another lamp with a metal reflector of the intensive type and good

Fig. 8.—Well Shaded Shower Fixture.

The popular shower fixture, if properly shaded, is well suited to localized lighting of a dining table, and permits plugging-in toasters, etc.

white-enamel interior finish should be placed over the stove about six inches high.

Another plan is to provide general lighting from a center ceiling socket supplemented with localized lighting like that over the stove wherever it is needed.

Bed Room.

One of the biggest problems in bed-room lighting is the elimination of shadows when using mirrors. There are two general ways to treat this. One is to have lamps at every point where they are needed to avoid objectionable shadows and the other is to provide general illumination

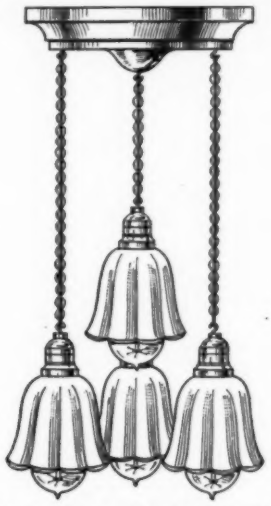

Fig. 9.—Horrible Example, of Which Numbers Are in Use.

The shower fixture as too commonly used with lamps not shaded sufficiently either as to length or density of shades.

from one outlet sufficiently diffused and sufficient in quantity to render the shadows unobjectionable. With electrical energy as cheap as it is now, the latter plan, although it does not give quite as good results, is likely to be chosen as it involves fewer outlets. To provide such a sufficiency of general illumination that shadows are not troublesome when looking into mirrors, indirect lighting is preferable although with a lamp of, say, 100 watts in a small bed room with light-colored walls the shadows are not likely to be very annoying if the lamp is simply inclosed in a light opal globe. More satisfactory elimination of shadows where general lighting alone is provided is obtained with indirect or semi-direct methods giving a light almost totally indirect. For the cheaper class of houses some of the inexpensive fittings devised recently for semi-direct lighting

Fig. 10.—Indirect or Semi-Direct Dining-Room Fixture With Sockets for Cooking Appliances.

by the use of standard opal reflectors upside down give very good results, as do also some of the cheaper indirect reflectors made to hang on the lamp sockets.

High-class bed rooms should be provided with indirect or semi-direct general lighting supplemented with brackets on each side of every mirror, the brackets either being permanent on the wall or a part of the piece of furniture.

Industrial Lighting from the New Aspect—I

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THIS is a brief summary of the modern ideas of industrial lighting as an important factor in the efficiency of production. The influence of adequate light on the employees of a factory is shown, and a statement made of the principles related to adequate lighting now generally accepted as a standard basis for these features of management, but which, ten or twelve years ago, were announced as newly discovered influences in the economy of factory production. The important advantages of good light, and a way in which to interpret them are given. Brief review of the development of electric lamps in recent years, and some of the changes it has made possible. The importance of the eye in lighting plans is emphasized; some of the elements which constitute satisfactory lighting given; and comments made from a report of the federal public health service. There are some notes on the British industrial lighting report; the conservation of light by reflectors; some effects of surroundings on the illumination of interiors; notes on factory lighting legislation, recommendations and conclusions.

ANY treatment of the new viewpoint towards industrial lighting would be very incomplete without a reference, at least, to the intrinsic value of adequate illumination to production in the industries. Two causes, in fact, have been largely responsible for the unparalleled progress in this field during the past decade. One of these has been the invention of new electric lamps, by means of which factory sections, hitherto lighted with great difficulty by the older types, have become not only bright and cheerful in the abstract, but have been transformed into far more effective working spaces. The other has been a growing appreciation by those responsible for industrial environment, of the advantages of good light. It is probably safe to say that this intelligent appreciation of the new and broadened possibilities of more cheerful work spaces on the part of factory owners and superintendents has been an influence of greater help to the cause of better lighting than any other single factor.

This increasing attention of industrial management to the environment of the employee seems to have been due to a natural swing of the pendulum. The phenomenal industrial development during the 60 years just over, had more or less of a tendency to deaden the senses of management and capital to everything except the manufactured product. Where factory employees, 60 years ago, were numbered in thousands, today they have reached the ten-million mark; capital invested in manufacturing has grown from approximately five hundred millions to ten billions. This tremendous development, for some reason, seemed, in a certain sense, to place the employee in the background for a part of this period of industrial expansion, but within a relatively few years he has changed, from a mere part of the routine, to a factor of great importance. "The man at the machine" has thus found a place in the foremost considerations of industrial management, and his effectiveness, as a part of the factory economy, has come to be acknowledged as dependent not only on the mechanical efficiency of the machine with which he happens to be working, but very largely on the physical surroundings which make up his working environment.

A New and Important Viewpoint.

The Industrial Commission of Wisconsin made a statement in one of its bulletins in 1913, which reflects the changing viewpoint. This statement, in part, is as follows:

Fig. 1.—Typical Example of a Factory Section With Very Low Ceiling, Lighted With 60-Watt Lamps and Modern Reflectors.

"There is a general awakening over the country among manufacturers to the economic value of conserving the human equipment of their plants, and there never was a time when so much attention was being given by progressive manufacturers to the subjects of shop lighting, elimination of dusts and gases, fresh air and general cleanliness. The manufacturers who have done the most along these lines are the most enthusiastic of their practical value."

Consider also the fact that statistics show an avoidable loss of more than two hundred million dollars annually from preventable disease among the industrial workers in this country. This is due largely to ignorance of the various phases of industrial hygiene, which constitutes a question not merely to be handled by so many janitors per unit of factory floor area, nor even by the installation of so many wash basins, or drinking fountains, but which is a problem of considerable intricacy calling in these days for a new viewpoint on the part of factory executives and managers towards the conditions which govern the work in their plants.

In the broad study of the factors which materially influence the effectiveness of production, artificial lighting and illumination have received a prominent share of attention. It has been ten or twelve years since an intensive investigation into the principles of factory lighting was begun in this country and abroad, and during this time, several conclusions have been reached concerning illumination in its relation to the workship. Today, from the standpoint of the adoption of these ideas, not only by a few enthusiasts, but very generally by the foremost authorities on factory and scientific managment, there may seem to be something of the commonplace attached to those principles, which, only a few years ago, were advanced in the technical press of this country as newly discovered factors of considerable consequence to the efficiency of industrial management.

Watts Per Square Foot of Secondary Concern.

The studies in the field of factory lighting have shown, first of all, that the consumption of current for lighting is an item which should be secondary to others of greater relative importance. Some shops, even today, are probably still deceived by the fancied idea that any form of lamp or system of illumination, which will reduce the monthly light bill, is of great concern to the accounting department. In this discussion, we shall not limit the treatment to a narrow basis of this kind. Reduced energy consumption is quite naturally an attractive consideration, but it should never be made the prime objective point unless, in so doing, there is no sacrifice of the efficiency of the lighting system in its relation to the broader influences involved.

Turning now to this more liberal phase of the lighting question, the experiences of recent years have shown that good light, in addition to its evident need, has a number of advantages and influences of so much importance to industrial management as to merit the most careful attention of those who are charged with its responsibility. In a recent study, by the writer, into these influences of good light, those discussed in the following paragraphs have seemed to stand out as of the greatest importance. To the industrial manager, who desires the highest production efficiency, and to the central station, who wishes to advance the status of factory lighting in its own territory,

Fig. 2.—Factory Section with Ceiling Height of 13 feet 6 inches, Equipped With 100-Watt Lamps and Glass Reflectors. Side Aisles Are Dark.

Fig. 3.—Same Section Equipped With 100-Watt Lamps And Metal Reflectors—Ceiling and Aisles Are Dark.

these influences should not only be of special interest, but they stand out as the underlying basis on which a campaign for better lighting should be waged. The reader is urged to study these influences, not in the abstract, but rather in terms of actual working conditions as these may fall within his range of observation from time to time. They are based more on actual experience than on theory.

The Outstanding Advantages of Good Light.

Accident reduction can probably be placed at the head of the list with propriety. A leading casualty insurance company has conducted investigations into this field, and, by published data, has demonstrated the astounding fact that nearly 25 per cent of preventable industrial accidents in this country are to be charged against poor lighting. The compensation laws of some of the states have made such a fact of extraordinary importance to any well ordered factory, and aside from any of the constructive economies of which good light is capable, its influence on accident reduction is obviously most important.

In a general report, the London *Illuminating Engineer*, February, 1914, (page 63) makes the following interesting comment on this phase of the industrial lighting situation:

"A prominent official of one of America's largest manufacturing companies is authority for the statement that insufficient illumination is frequently held by juries to be contributory negligence, and in the defence of accident suits the lawyers of this company find it a valuable point to offer testimony by a competent witness to prove the adequacy of lighting arrangements in this company's plants."

Among other advantages which, in a general way, have a bearing on accident reduction, is that of the reduced eye strain which should accompany superior lighting facilities; also the tendency for good lighting to improve the working and living conditions of factory employees during the hours of work; and its tendency to promote order and neatness in the establishment. These major and minor contributory influences of light on accidents have been made the basis of considerable detailed investigation by the Departmental Committee on Lighting in Factories and Workshops in Great Britain. In the first report of this committee, published in 1915, it was demonstrated with reasonable clearness that in a previous year (as typical) during the course of said investigations, there was an increase of considerable proportions in the accidents during the hours of artificial light as against the accidents during daylight hours in most of the industries investigated. Table I shows some of the instructive data accumulated by the British committee bearing on the relation of light to accident rates.

To the advantages thus far enumerated there may be added in the way of constructive items, that good light tends to greater accuracy in workmanship and increased production for the same labor cost; also to added contentment of the workmen, who are surrounded by a satisfactory environment; and to a more effective supervision and superintendence than can possibly be the case under gloomy and dark surroundings. Exact facts regarding these economies due to improved illumination have always been more or less difficult to obtain, and they would form, if available, an argument of unequalled attractiveness to the shop owner who faces an expenditure for new lighting equipment, because of the added assurance such figures would give as to the wisdom of such an expenditure.

How to Look at These Advantages.

The fact, therefore, that the actual material advantages of good light are somewhat difficult to obtain in cash equivalents, makes it essential, in most cases, that they be interpreted in the most liberal manner and through the eyes of experience. To the manager who stops long enough to consider the matter fairly, they form arguments of utmost consequence and require little more than the statement to form a basis for making necessary improvements.

Sometimes an analysis of existing adverse conditions will cast the die in favor of a needed expenditure for improved light. In almost any manufacturing concern, it is a simple and effective scheme to estimate closely the gross wages, superintendence and indirect expense chargeable to a unit of shop-floor area, for example, 100 or 1,000 square feet. If, then, a similar careful estimate is made of the cost of the best lighting for this same area, the ratio of the two will indicate at a glance just what wage-time equivalent is involved in the substitution of a new for an old inferior lighting system. This method of calculation and the conclusions which may be deduced therefrom, are illustrated in the following table:

Total unit area	640 square feet
Total wages, superintendence and indirect factory expense	$7,000
Total cost of best lighting per annum	$ 50
Percentage cost of lighting in terms of wages	0.7 per cent.
Time equivalent of lighting cost in terms of wages	4 minutes per day

If, therefore, the best form of lighting is installed and it results in the saving of at least four minutes per day in the work of the employees involved in this unit area, the good lighting pays for itself. Improper lighting facilities may easily result in time losses of one-half to one hour per day, particularly during winter months, so that the

TABLE I.—ACCIDENT RATES FROM DIFFERENT CAUSES IN VARIOUS INDUSTRIES.
From First Report of Departmental Committee on Lighting in Factories and Workshops in Great Britain, Vol. I, p. 25.

Causation (1)	INDUSTRY (2)	TOTAL ACCIDENTS: Summer Months (Excluding August) (3)	TOTAL ACCIDENTS: Winter Months (4)	Daylight Accident Rate Per Hour (Deduced from Summer Months) (5)	ACCIDENTS DURING WINTER MONTHS: Daylight (6)	ACCIDENTS DURING WINTER MONTHS: Artificial Light (7)	Artificial Light Accident Rate Per Hour (8)	Per Cent Difference Between Daylight and Artificial Light Rates.* (9)
Machinery Moved by Mechanical Power	Textile	3,700	4,726	3.09	3,089	1,637	4.17	+35
	Wood	1,225	1,557	1.02	1,023	534	1.36	+33
	Shipbuilding	917	1,057	0.77	766	291	0.74	—4
	Engineering	5,134	6,192	4.26	4,319	1,873	4.94	+16
	Other Industries	8,958	10,794	7.48	7,475	3,319	8.44	+13
	All Industries	19,934	24,326	16.62	16,672	7,654	19.64	+18
Molten Metal	Founding	1,275	1,505	1.07	1,065	440	1.12	+5
	Other Industries	1,810	2,236	1.51	1,512	724	1.84	+22
	All Industries	3,085	3,741	2.58	2,577	1,164	2.96	+15
Struck by Falling Bodies	Founding	552	609	0.46	461	148	0.38	—18
	Shipbuilding	1,549	1,798	1.30	1,293	505	1.29	—8
	Docks	1,139	1,506	0.95	951	555	1.42	+49
	Building	165	174	0.14	138	36	0.09	—33
	Engineering	2,849	3,645	2.37	2,400	1,245	3.29	+38
	Other Industries	5,048	6,576	4.22	4,216	2,360	6.00	+42
	All Industries	11,302	14,308	9.43	9,459	4,849	12.46	+32

*A positive sign indicates that the accident rate is greater by artificial light than by daylight.

expenditure for good light can in many cases be interpreted as a paying investment rather than a mere expense. A quotation[1] from the report of the British Departmental Committee, previously referred to, has an interesting bearing on this point:

"The effect of improved lighting in improving the quality and increasing the output of work has been noted by many witnesses. In one instance the output was diminished from 12 to 20 per cent during the period of artificial lighting, and in another the earnings of the workers increased 11.4 per cent after the installation of a better lighting system. Confirmatory evidence has been published in the United States of America."

New Lamps and New Methods.

While the foregoing advantages have undoubtedly had a profound influence on factory managements and have gone far towards forcing the acceptance of the modern ideas of good lighting on those responsible for industrial welfare, the remarkable advance in the field of factory lighting has depended for its physical possibilities almost entirely on the invention and design of new lamps and accessories. There has probably been no one type of lamp, which has done so much to promote active interest in industrial illumination as has the introduction of the Mazda unit, and the accompanying development of efficient reflectors. In addition to the feature of making available small and medium-sized units to fill in the gap of the very small and very large lamps of a decade or so ago, the Mazda lamp has given to the industrial lighting problem, a unit of a sufficiently high efficiency to make general illumination from overhead lamps entirely practical for working intensities.

Again, since the initial installation of mercury-vapor lamps for industrial purposes in this country in 1903 (13 years ago) the use of this type has grown to relatively large proportions in such industries as the foundry, machine shop, woodworking plants, textile mills, newspaper and printing establishments, paper mills, clothing manufacturing plants, power houses, glass factories and shipping and storage spaces.[2]

In the arc-lamp types, developments in recent years have resulted in the flame-carbon long-burning unit, which is probably the only type of arc lamp which has been particularly useful in factory lighting. In the class of units with very high candlepower, the quartz mercury-vapor lamp has received some attention, especially in the illumination of large areas such as the yards of steel mills.

Some Results Made Possible by New Lamps.

Prior to the invention and marketing of the Mazda lamps, there were, essentially speaking, but two types of electric *lamps*, namely, the *small* carbon-filament lamp, and the *large* arc lamp. Not only was crane clearance a limitation in many instances, making it out of the question to use arc lamps because of the physical impossibility of mounting these lamps overhead in the available clearance space, but it often became impracticable to consider the use of arc lamps overhead in spaces with low ceilings in sufficient numbers to provide general illumination. It was not an uncommon practice in such instances to attempt to use a few arc lamps or possibly a cluster of incandescent lamps here and there to produce a low degree of general light, and to depend almost entirely on individual carbon-filament lamps over and close to each machine tool.

In probably no other way has the Mazda lamp filled a greater need than in just such cases, and today we find as a common instance, work spaces like that shown in Fig. 1, where ten years ago gloom prevailed most of the day, and where now, even with a ceiling under twelve feet high, Mazda lamps of the 60-watt size furnish absolutely well distributed and softly diffused light under the entire mezzanine floor which serves as the ceiling.

The availability of such medium-sized lamps makes it logical to emphasize today a comparatively new method of lighting, that is, the overhead system, which is a marked contrast to older methods, wherein in nearly all cases, the overhead lamps, when used at all, merely served to furnish a small amount of general illumination, and where individual lamps were almost entirely depended upon for the illumination by which work was carried on. Even today, however, when the overhead method has received such widespread recognition, there is considerable misunderstanding as to its cost and effectiveness, the impression sometimes being retained that it is too expensive to be practical. Common experience in large factories seems to demonstrate that this is not the case.

(To be continued.)

1 From the London *Illuminating Engineer*, Vol. VIII, No. 9, p. 375.
2 Transactions of ninth convention of Illuminating Engineering Society. "Industrial Lighting with Mercury-Vapor Lamps," by W. A. D. Evans.

United States Navy Department Adopts Geared Turbines for Destroyers.

It has recently been announced that the United States Navy Department intends to re-engine ships in the service that are now equipped with direct-connected turbines. The first two to be so constructed will be the destroyers *Henley* and *Mayrant*. These are to be equipped with geared turbine units, for which contracts have been placed with the Westinghouse Machine Company, of East Pittsburgh, Pa.

Geared turbines have been decided upon due to the fact that they are lighter and take up less space than direct-connected units, are much better mechanically because of their small size, and materially reduce steam consumption at all speeds and especially at cruising speeds. This reduces the fuel consumption and increases the steaming radius, which is an important feature.

The *Henley* was built by the Fore River Shipbuilding Company, of Quincy, Mass., and completed in the fall of 1912. The main machinery consisted of two direct-connected marine turbines with two compound cruising engines which were connected to the main turbine shafting by means of jaw clutches. The turbines had 14 ahead and two reverse stages. Steam was supplied to the turbines at a pressure of 250 pounds by water-tube boilers for which oil was used as fuel. The machinery to be supplied by the Westinghouse Machine Company will consist of two complete expansion geared turbine units of the impulse reaction type with Kingsbury thrust bearings, and two geared cruising units. It is to be installed in the same engine room space and to connect with the existing propeller shafting, and drive the propellers at the same speed as formerly. The two main turbines will each have a capacity sufficient to move the ship at a speed of 15 knots per hour. They will be connected to the main turbines by clutches and will be used only up to a speed of 15 knots. After this speed has been attained they will be disconnected and the main turbine alone used. Reduction gears will reduce the turbine speed of 3,000 revolutions per minute down to 640 revolutions per minute for the propeller shaft.

The *Mayrant* was built by the William Cramp & Sons Ship & Engine Building Company, of Philadelphia, Pa., and was delivered to the government in 1911. The machinery consisted of two turbines without cruising engines. The turbines were designed to develop 13,000 shaft horsepower at a speed of 650 revolutions per minute and with a steam pressure of 250 pounds gauge. They had 16 stages ahead and 7 stages astern. Steam was supplied by four water-tube boilers and oil was used for fuel. The new machinery to be furnished will be essentially the same as that for the *Henley*. The main turbines, however, will each have a capacity of 7,000 shaft horsepower at a speed of 629 revolutions per minute.

Business Conditions in the Industry

A Summary of Views Recently Expressed by Leading Manufacturers and Supply Jobbers of Electrical Equipment Respecting Manufacturing and Selling Conditions

MANUFACTURING and selling conditions during the past twelve months have been unique in the history of electrical development. There have been times before when under the stimulus of general prosperity the demand for electrical equipment exceeded the supply and manufacturers and distributors alike were in a position to stabilize the prices and assure themselves of a generous margin of profit as a reward for initiative and efficiency in the management of their business. The present situation is unlike any other time in that there is, for some time at least, little opportunity for over-expansion and over-production. It is true that other industrials in order to meet the demand for their products have advanced construction and developed capacity which only the present abnormal demand for these products or the creation of entirely new demands for entirely new products will satisfy when the present pressure is released. In the electrical industry, that is the manufacture of electrical equipment, the high cost of material, the difficulty of securing adequate supplies of material, and the difficulty of securing skilled labor under economic and efficient conditions, have restricted manufacture, have made impossible in some cases even working up to full capacity, and have exercised the severest restraint upon over-development and over-production. Furthermore, these very elements, while greatly increasing the volume, has not in the same measure increased the margin of profit. On the other hand, the demand has been consistent and maintained to such a degree that the industry can be said to be on a more profitable and satisfactory basis than ever before.

With a view to securing a first hand impression of manufacturing and selling conditions as they exist among the various leading organizations in the country, an inquiry was recently directed to the leaders in the industry and the following summary of opinions will be found interesting as a criterion and guide respecting fundamental conditions as they exist in manufacturing and selling in the industry today.

Incandescent Lamps.

There is hardly any line of industry which has not expanded tremendously and sale of incandescent lamps has increased proportionately. One of the immediate responses to increased industrial activity is a greater demand for industrial lighting units. The incandescent lamp industry has increased 20 to 25 per cent in volume over 1915. W. G. McKitterick, manager of sales of the National Lamp Works of the General Electric Company, points out that the greatest technical development has been in the perfecting of the Mazda C gas-filled lamp, especially in higher wattages and particularly as they are employed in industrial lighting of mills, factories, etc.

Elliott Reid, manager of the Advertising Department of the Westinghouse Lamp Company, states that the Westinghouse production of incandescent lamps is about double what it was a year ago. Development work is receiving constant attention and while intense production may have retarded this somewhat during the last year, it is evident that from now on development work will be given more attention.

The Wire Market.

In common with all other manufacturers in the metal lines, the wire makers have had to adjust themselves to new conditions. There has been some handicap on raw materials, but Arlington Bensel, vice-president of the Driver-Harris Wire Company, Harrison, N. J., is of the opinion that we have passed through the most difficult stages of new developments and from now on there will be more rapid selling.

H. T. Dyett, president of the Rome Wire Company, Rome, N. Y., believes that most of its customers are buying for immediate requirements and that there is little overbuying or speculating in evidence. Demands for material seem to be as insistent now as at any time and he confidently looks for a continuance of present business conditions. Inefficient labor has been one of the serious things to contend with this summer, but this situation is being relieved.

Molding and Conduit.

C. E. Corrigan, vice-president of the National Metal Molding Company, Pittsburgh, Pa., a close student of national affairs and well informed with regard to conditions in the industry, believes that as compared with the same period last year the balance of the year will show the same relative increases. There has been an apparent hesitation on the part of purchasers in committing themselves for their possible requirements for the balance of the year since early in July. This has been occasioned by the uncertainty with regards to the continuance of present prices on raw material. High cost of structural iron and steel has halted building operations and, consequently, has affected the demand for rigid steel conduit and fittings. On the other hand, large operations, such as factory extensions, power plants, railroad terminal stations, and other operations contracted for before the beginning of the present advance to higher prices on iron and steel structural material has stabilized the market and made possible a good demand.

J. A. Campbell, president of the Youngstown Sheet & Tube Company and the Western Conduit Company, Youngstown, O., directs particular attention to the scarcity of labor, the intense heat during July and August, with high prices which have greatly increased selling cost. Semi-finished steel, especially open-hearth, has never been so scarce and difficult to secure as at the present time. There is a large demand for a number of steel products abroad, and this, together with home consumption, makes evident a strong situation. He is of the opinion that there can be no change in the future until the close of the war abroad.

H. B. Kirkland, vice-president of the American Conduit Manufacturing Company, says that within the past six months we have witnessed everything from a pyrotechnical display to a simmering down to fairly normal conditions. This company has gained considerably in volume over last year and inquiries in hand suggest that building operations on a large schedule are contemplated in many parts of the country. This company recently introduced a new wiring specialty, "Wiremold," and the interest and inquiries to date have manifested a market far beyond the most sanguine expectations of the producers.

Heavy Construction.

Notwithstanding the hesitation attending the developments of many large construction projects, the manufacturers of these materials have experienced a tremendous demand. In almost every instance factory resources are being taxed to an extreme limit, the greatest difficulty being the securing of adequate supplies of raw materials. Forgings and malleables particularly have been and are hard to get. A. L. Wilkinson, secretary of the Ohio Brass Company, believes that this condition will continue through the better part of 1917. This company has resolved itself largely into a purchasing organization and by having special representatives at different points where raw material is being secured has been able to have

this material available approximately on time and in the order in which it is required.

J. W. Wooley, sales manager of the Oshkosh Manufacturing Company, Oshkosh, Wis., states that the operating companies in spite of high prices for material are doing considerable construction work. This company is, therefore, making preparations for the largest development that the electrical industry in this country has ever seen.

Opinion is mixed with regard to cedar pole business. W. C. Sterling, Jr., secretary and treasurer of W. C. Sterling & Son Company, Monroe, Mich., feels that the business is not as progressive as it should be. High prices for copper and steel rails have discouraged building of electric roads, telephone lines and even fences. He believes, however, that in spite of high prices a good deal of new construction and reconstruction is imminent and as soon as the political situation is settled and prices of steel and copper become more stable that there will be a great increase in this character of construction.

H. W. Reade, vice-president of the National Pole Company, Escanaba, Mich., states that the volume of business during the past six months has been quite satisfactory and considerably ahead of the same period in 1915. It is expected that the output of poles will be considerably reduced during the coming winter on account of scarcity of labor. In such a case, high prices will probably prevail.

In underground conduit construction there is the same evidence of considerable activity. Labor has been scarce, independent and at a high wage scale. This combined with high prices for copper has been deterring many from going ahead with construction work. These will proceed as soon as these conditions change. There is no tendency, however, to let up on underground construction and G. M. Gest is looking forward to some record underground construction work to take care of the developments which have been held back owing to unfavorable conditions.

Generating and Motor Equipment.

The same story persists in the manufacture of generating and motor equipment. H. A. Otterson, sales manager of the Ridgway Dynamo and Engine Company, Ridgway, Pa., states that for the past twelve months it has been difficult for the manufacturer of machinery, particularly electrical apparatus, to adjust himself to the unprecedented demand and the rapidly fluctuating prices for all raw materials. Manufacturers and buyers as well, however, have in a great measure adjusted themselves to these trying circumstances. The demand is not quite as pressing as it was six months ago.

Walter Robbins, vice-president of the Wagner Electric Manufacturing Company, St. Louis, Mo., finds difficulty in predicting the actual extent to which sales might have gone were manufacturers in a position to accept any and all orders. It is very likely that many sales made in April and May will not be executed until the fall, winter or next spring. This company's experimental departments are going ahead at the usual speed with new things that will be placed in the shop as soon as available manufacturing space can be provided.

L. H. Hamilton, president of the Wisconsin Electric Company, Racine, Wis., tells also of a large volume of business and the handicap in getting certain materials. He is looking forward to a steady increase in domestic business and a marked increase in foreign business, and the company is laying plans accordingly, buying new equipment and enlarging its plant capacity in general.

Charles Blizard, third vice-president of the Electric Storage Battery Company, Philadelphia, Pa., points out that there has been difficulty in taking proper care of the very large business offered in all lines of storage battery work. The company is making extensive additions to its plant and equipment, and will go into one of its new buildings within the next ten days. Shipments are showing material improvement, and with improved facilities prompt service will soon be available. Mr. Blizard is looking forward to a continuance of good business.

Lighting Fixtures, Distributing and Controlling Apparatus and Specialties.

J. Warren Ripple, president of the George Cutter Company, South Bend, Ind., states that business in electrical lighting fixtures and distributing apparatus has increased in volume approximately 50 per cent over the same period last year, and that the prospects for the balance of the year are good.

F. S. Baldwin, general sales manager of Pass & Seymour, Inc., Solvay, Syracuse, N. Y., states that the company has had a most successful year. The factory is running to a good demand, and orders are coming in to their entire satisfaction. The company is looking forward to and making plans in anticipation of a continuance of good business.

J. C. Boyton, general manager of the ADAPTi Company, Cleveland, O., is finding difficulty in making prompt shipment. This company's manufacturing facilities are in splendid shape, and the trouble lies entirely with the manufacturer of the raw product. Mr. Boyton could have doubled and possibly tripled the output, with a consequent comparable increase in sales, if better deliveries could have been received from the mills.

L. L. Brastow, sales manager of the Trumbull Electric Manufacturing Company, Plainville, Conn., contributes a decidedly interesting homily upon the general situation. Here is another company which could have materially increased its output and sales if manufacturers and producers of raw material could have adequately supplied their requirements. Trade embargoes, both on incoming and outgoing shipments have been an additional hardship. With regard to the outlook, Brastow sees a prime necessity for positive readjustment in many directions. Chief among these is the imperative desirability of understanding and sympathy upon the part of governmental administration with manufacturers and distributors. He believes that with a business administration under the direction of business men, that there will not be any smashing blows struck when the present pressure eases off, but rather that business will go on in a normal way.

C. P. LaShelle, vice-president of W. R. Ostrander & Company, New York, says that there was a considerable increase in business during the first six months of the year, and that from the present outlook these conditions will continue throughout the year.

J. H. McGill, president of the McGill Manufacturing Company, Valparaiso, Ind., announces an increase for the first six months of 46 per cent over the same period in 1915. He also is of the opinion that this condition will be maintained at least for the balance of the year.

A. W. Berresford, vice-president and general manager of the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., reports his company exceedingly busy, with the plant operating practically at capacity. His own feeling is that there is every indication of a continued prosperous business on nearly normal lines for a period of at least two years and possibly three.

Leonard Kebler, president of the Ward Leonard Electric Company, Mount Vernon, N. Y., finds that buyers are viewing the situation more reasonably and buying with more sanity for carefully estimated requirements. The company has been rather fortunate in that it has just moved into a recently completed factory capable of large and rapid expansion. This has relieved it of production difficulties. Mr. Kebler believes that business will continue on its present basis for at least another year, and that material prices will remain about as they are now for that length of time.

The Blake Signal & Manufacturing Company, Boston, Mass., has enjoyed exceptionally good business. E. J. Burke, president of the company, believes that the termination of the war will be of decided benefit to business in this country.

On the other hand the American Platinum Works, Newark,

N. J., finds business in its electrical lines dull, due undoubtedly to the high price of platinum.

B. H. Howell, president of the Hemming Manufacturing Company, Garfield, N. J., reports that selling conditions in his company have been very favorable during the past six months, fully compensating producing difficulties which have been due to increases in the cost of labor and material.

The Meadows Manufacturing Company, Pontiac, Ill., looks for good business the balance of the year. Embarrassing material conditions are adjusting themselves favorably and better weather conditions make the situation in this territory look optimistic.

H. H. Hoover, general manager of the Hoover Suction Sweeper Company, New Berlin, O., reports business two and one-half times increased over a year ago. The company is planning to take care of a great increase in demand, as it is now completing a new factory with four times the present available capacity.

Among the Jobbers.

In so far as the distribution of electrical material is concerned, the universal note is to the effect that the wholesaling of electrical material the country wide has been passing through a most unusual period. This change in conditions has undoubtedly been of benefit both to the manufacturer and the jobber, as there has been the greatest opportunity for a demonstration of better methods of co-operation between the producer and the distributor. The buyer, also, has come to a better realization and a greater appreciation of his dependence upon the efficient jobber, and, in these times of emergency buying, has increased his respect a great deal for the promptness and the willingness with which the wholesale distributor of material has stood between him and embarrassment. Many prominent jobbers of electrical supplies have been interviewed and it is a cause for congratulation that in every instance, in every part of the country, there is evident a satisfactory volume of business upon a basis that will allow the jobber to demonstrate the real effectiveness of his position as a technical distributor of technical equipment.

The Eastern States.

C. D. Williams, assistant manager of the Stuart-Howland Company, Boston, Mass., states that the volume of business is heavy and has been that way for a number of months. The number of items moved at this time of the year is unusual but the demand has, to a large extent, been limited by factory and transportation conditions.

Frank H. Stewart, president of the Frank H. Stewart Electric Company, Philadelphia, Pa., reports 1916 sales volume greater so far this year than any previous year and that the outlook is good for several months to come.

L. M. Levine, of the Belcher & Loomis Hardware Company, Providence, R. I., reports that the first eight months of this year shows the largest amount of business for any similar period in the history of the company. There is indicated a considerable demand for the immediate future.

O. F. Rost, treasurer and general manager of the Newark Electrical Supply Company, Newark, N. J., calls attention to the point emphasized above that present conditions have demonstrated as never before the necessity of the jobber as an economic factor in the distribution of supplies. After the war competition will be keener than ever and this behooves a closer co-operation between the manufacturer and the distributor.

W. C. Graham, of the W. T. McCullough Electric Company, Pittsburgh, Pa., states that they have had a succession of good months ever since before last year's holidays. Prices have been maintained and the margin of profit has been considerably bettered.

W. E. Robertson, president of the Robertson-Cataract Electric Company, Buffalo, N. Y., finds business exceptionally good as a result of increased buying by all classes of people affected by the stimulation of business induced by war orders at abnormal profits. The outlook for the balance of the year he considers good but much will depend upon the elections and the continuation of the war. "Billy" is freely admitting that if the war ends and present political events continue as they are we need expect anything but good business for the next two or three years; while if the war ends and the proper change in administration is made we may expect good business conditions.

Middle States.

George A. McKinlock, president of the Central Electric Company, Chicago, Ill., finds that production along staple lines is keeping up with consumption and, in certain directions, is overtaking the demand. All signs and portents indicate that fall and winter business is very promising.

This is also the opinion of W. W. Low, president of the Electric Appliance Company, Chicago, Ill., who believes that it will be a question of securing material rather than securing business this fall.

M. B. Austin, president of M. B. Austin & Company, Chicago, Ill., while conservatively inclined, is exceedingly optimistic. The demand for the past eight months has exceeded the supply and during the first six months of the year this company's business has been the largest of any similar period since its organization in 1894. While higher prices of building material have tended to retard much projected work, there have been many activities in many fields which have more than offset any difference in building operations.

R. P. Oblinger, president of the Indianapolis Electric Supply Company, Indianapolis, Ind., reports that gross sales to August 1 of the present year are 46 per cent over the same period of 1915. A certain portion of this is accounted for in increased cost of material, but the actual volume is running about 25 per cent higher.

Walter S. Bissell, vice-president and sales manager of the F. Bissell Company, Toledo, O., says that the volume of business to date not only exceeds, in good measure, that of a year ago but he sees no indications that point to an early decrease in demand. This company is also the manufacturer of a number of well known specialties and, in spite of the difficulty in securing raw material for the production of these, he finds its manufacturing end just as busy as its distributing end.

M. A. Bridge, Jr., manager of the supply department of the Erner & Hopkins Company, Columbus, O., is enjoying a volume of business at present far beyond his expectation. Despite slow deliveries which have handicapped it, this company has prepared itself to take care of its trade in a satisfactory manner.

Southern States.

Walter S. Clark, secretary of the James Clark, Jr., Electric Company, Louisville, Ky., contributes an interesting sidelight on the situation. There has come about during the last 10 years a decided change in the distribution of electrical supplies. Many lighting plants in the southern territory, years ago individually or locally owned, have become syndicated properties. This applies also to telephone companies. Consequently, the jobber has been compelled to look to other channels of distribution, such as contractors, hardware stores, general stores, drug stores, etc. The old scheme of merchandising electrical supplies on a complicated discount system is rapidly passing away, and the one-discount-of-net-price system is taking its place. The margin of profit has been materially cut down and is going to be more so every day, selling standard material in broken package quantities at standard package quantity discounts to meet competition from mail order houses and concerns which are using stable electrical supplies as leaders to get business on more profitable lines. This is a time, therefore, for the distributors of electrical supplies, under the improved conditions, to take advantage of the situation and establish a fair and proper margin for doing business.

Another interesting sidelight comes from W. R. Herstein, secretary and treasurer of the Electric Supply Company, Memphis, Tenn. Business in this territory became practically nor-

mal about May 1, and has continued so up to the present time. The recent rigid enforcement of the prohibition laws in large southern cities has resulted in the vacating of many desirable up-town business locations. Until these locations are reoccupied by establishments of a different character, building operations in the large cities of this section will necessarily be limited. The small towns, however, which have had prohibition for many years, are not affected, and crop conditions for several months have been such that the merchants in these towns are enjoying unusual prosperity. This has created enough new business in the way of mercantile, industrial and residence building to practically offset the diminished volume in the large cities; in addition to which these small towns are now becoming very ambitious in the way of white-way equipment.

Edward Jumonville, president of the Electrical Supply Company, New Orleans, La., reports a tendency to a betterment in conditions due largely to bumper sugar and cotton crops. While practically everything is selling at a higher price, the volume is, of course, greater, but the demand is not unusually heavy.

North Central States.

C. J. Litscher, president of the C. J. Litscher Electric Company, Grand Rapids, Mich., reports business good. "Chris" says that he doesn't believe they are selling any more merchandise today, except that prices are higher and consequently the volume is greater.

J. M. Hannaford, Jr., manager of sales of the Northwestern Electric Equipment Company, St. Paul, Minn., states that business for the first seven months of the year has been somewhat above normal volume. Mr. Hannaford points out the remarkable service which the jobber has furnished under extraordinary conditions. He has just returned from an extended trip covering the greater part of this territory, and finds general crop conditions and business conditions such as to indicate business considerably ahead of the same period last year. The development in electric lighting plants and telephone companies in the smaller towns in this territory during the past summer has been marked, and from present indications there will be a larger development this fall when crop conditions are adjusted.

B. B. Downs, president of the St. Paul Electric Company, St. Paul, Minn., reports volume for 1916 much larger than for last year covering the same period. There is no pessimistic talk in this territory, and a large volume during the coming fall and 1917 is expected.

A. W. Lindgren, general manager of the Northern Electric Company, Duluth, Minn., judges from present indications that the demand for electrical supplies will be considerably greater than it was last year.

Frank M. Bernardin, president of the B-R Electric & Telephone Manufacturing Company, Kansas City, Mo., advises that during the seven months of the year business has shown an increase of a little over 30 per cent over the same period in 1915, with July giving the company the largest month in the history of the organization. He anticipates no decrease in demand for material during the balance of the year. While reports covering crop conditions are rather pessimistic at this time, unless there is a crop failure extending over the entire southwest, Mr. Bernardin does not expect much falling off in the demand for electrical machinery.

Max McGraw, president of the McGraw Publishing Company, Sioux City, Iowa, reports good business at Omaha and Sioux City, with the prospect fully as good for next year. There is some possibility of the failure of the spring wheat crop in a part of this territory, putting a damper on next year's business.

J. B. Terry, president of the J. B. Terry Company, Cedar Rapids, Iowa, has enjoyed an unusual increase in business. A good deal of this, however, is due to increase in prices. He finds crop conditions good.

Western States.

R. Ackerman, of the Capital Electric Company, Salt Lake City, Utah, advises that the territory has shown a considerable increase over previous years, but that business in large apparatus has been only reasonably good. He expects a continuation of the present output for several months.

Carl M. Will, manager of the Fobes Supply Company, Portland, Ore., reports that business for the past 18 months has not been particularly good in the western half of Oregon and Washington. Sales for 1916 show some little increase over 1915, but business is not yet back to what may be considered a normal basis. This is on account of the fact that the western half of this territory is largely dependent upon the lumber industry, and trade in those lines has been quiet. This is partly due to the fact that the mills find it difficult to make deliveries on account of shortage of cars, but more particularly on account of the withdrawal of ships from the lumber trade. The electrical supply business is more or less dependent on new construction for its volume; therefore, a slack time in the lumber business necessarily cuts down the volume of the electrical supply business. Business in the eastern half of Oregon, Washington and in Idaho is very good and conditions in that part of the territory are prosperous, that district being largely dependent upon wheat raising and mining. They have a big wheat crop which will bring a high figure and the mines are more prosperous than they have been for the past 20 years. The present indications are that there will be no improvement in the western part of the territory within the next few months, but it is expected that quite a marked improvement will prevail for the early part of next year.

Electric Vehicles Prominent in Electrical Exposition—Test Run Being Planned.

Electric vehicles, both pleasure cars and commercial types, as well as the various accessories, will hold a prominent place in the New York Electrical Exposition of 1916, which will be held at Grand Central Palace, October 11 to 21. As in the past the automobile side of the exposition will represent the latest developments and the last word of progress in electric-vehicle manufacture. A test run of unusual interest is now being planned to be held during the exposition. The Electric Garage of New York City, one of the largest and most perfectly appointed electric garages in the country, will have an exhibit representative of the work it is carrying on. Among the latest types of pleasure vehicles to be seen will be the Baker, R. & L. and Detroit cars. Among the exhibitors of commercial cars will be the General Vehicle Company, the Walker Vehicle Company and the Ward Motor Vehicle Company. The Edison Storage Battery Company and the Electric Storage Battery Company will have interesting and comprehensive exhibits.

Plans for New England Contractors' Convention.

Tentative arrangements have been made for the convention of New England electrical contractors at Hartford, Conn., the latter part of September. The affair, which will include a large Electrical Show in the Foot Guard Armory, will be under the auspices of the Connecticut Contractors' Association. The Hartford convention will mark the establishment of annual conventions for all New England. Heretofore the state associations held individual conventions.

The business session will be of particular interest. Many subjects of vital interest to contractors will be discussed and ideas disseminated which will be of value to the business of every member present.

The sessions will be held on September 26 to 28, a "better acquaintance" dinner to be held the first evening. Ladies are especially invited to attend the convention.

Present-Day Tendencies in Street Lighting

A Discussion of the Various Types of Illuminants and Street-Lighting Accessories Available, Data on Installation Practice and Operation and Some of the Engineering Aspects of Street Lighting

By Preston S. Millar
General Manager, Electrical Testing Laboratories

THE recent increase in efficiency of light production and the development of merchants' lighting known as "White Way Lighting" have given an impetus to the use of higher intensities in street lighting. This movement is still under way, new and remodeled installations recording distinct advances over earlier installations in respect to intensity. An added illuminating effectiveness thus achieved has been enhanced by the demand for more artistic posts and fixtures, promoting the attractive appearance of the installation both by day and by night. While municipal appropriations for street lighting are larger than formerly, it is doubtful if there has been much increase per capita. Thus it is the higher efficiencies of illuminants and the growing preference for tasteful fixtures that chiefly are responsible for the advance of recent years in street-lighting practice.

Illuminants.

The most striking development of recent record is of course the gas-filled tungsten lamp—the Mazda C lamp. This illuminant has now been brought to a degree of operating satisfaction which is ample as regards reliability, though it is characteristically lacking in rating consistency. While it by no means attains the "half-watt" consumption rating which is attributed to it abroad and while it does not attain the highest light-producing efficiency among practicable street illuminants, yet its efficiency is so high that, in combination with some of its other excellent qualities, it occupies first place among illuminants recently installed. In flexibility the Mazda street-lighting system is pre-eminent. An ample range of lamp sizes in both the multiple and the series types, ready applicability to a great variety of operating conditions and the availability of forms (though of inferior performance) for service tip upward make the lamp applicable to almost any operating condition. It is not entirely settled in practice whether the Mazda C lamp, due to the destructive persistence of an arc across the rupture, occasions serious difficulty upon direct-current series circuits when a filament rupture occurs in operation. Conflicting reports are received regarding this detail of performance. Where such difficulty is encountered, experimental devices constructed within the lamp and also devices external to the lamp are being tried for its elimination.

It is understood that it is still regarded as unwise to operate Mazda C lamps in series with arc lamps. The incandescent lamps operate at a temperature which is so near that of the melting point that their ability to withstand overload is much reduced. Therefore on arc-light circuits which offer considerable likelihood of even momentary surges, the Mazda C lamp cannot be looked to for as satisfactory service as when operated on a circuit of incandescent lamps exclusively.

Whether or not the color characteristic of light from Mazda C lamps is as well adapted to street-lighting purposes as is the whiter light from arc lamps is a moot question. It is perhaps a preponderant opinion that such is not the case.

The illuminant which occupies second place among the newer installations and which today appears to be the only illuminant capable of competing with the Mazda C lamp for street lighting in this country is the magnetite lamp. The magnetite lamp with rare exceptions is the only lamp which the Mazda C has not succeeded in replacing in considerable quantities. This illuminant has been improved in recent years by extension into other sizes and types, by the development of a higher-efficiency electrode and a simplified mechanism.

In establishing the relative illuminating value of these two types of lamps, complications are encountered. The four-ampere pendent magnetite lamp with standard electrodes in the long run is superior in illuminating value to the 400 candlepower Mazda lamp, but in the long run is inferior to the 600-candlepower Mazda lamp. The usual equipment for these lamps consists for the magnetite of a clear globe with internal reflector and for the Mazda lamp of a light-diffusing globe. In the illumination of streets in which the lighting of building fronts is not important, the magnetite lamp, by reason of its more effective light distribution, probably falls in the same class as the 600-candlepower Mazda lamp. In streets in which building fronts are to be lighted, it is inferior to the 600-candlepower lamp, and furthermore in the form described is not suitable.

Both lamps are used occasionally with refractors. Such use adapts them to application strictly in streets in which building fronts are not to be lighted.

Speaking comparatively, it is understood that the investment costs for the magnetite system are considerably higher than for the Mazda C system, while the total costs are in some cases higher and in some cases lower, depending upon local conditions. The Mazda lamp profits by a greater flexibility and range of sizes, while the magnetite lamp, in the opinion of many, profits by a light of superior color. In the matter of efficiencies of light production, the comparison is substantially as shown, the figures being derived from data of the Lamp Committee of the Association of Edison Illuminating Companies as published during 1915, revised for certain slight changes in the efficiencies of the Mazda lamps.

Low-pressure gas mantle lamps are falling into disuse and the same may be said of gasoline mantle lamps. As American conditions do not appear to be favorable to the utilization of pressed-gas lamps, the result is that street lighting is being given over almost entirely to electric lamps.

Accessories.

The greater attention which has been given in recent years to the illuminating-engineering aspect of street lighting has led to the more general use of diffusing globes of

one type or another, which the high brilliancy of street illuminants has rendered almost imperative if good lighting results are to be secured. Among Mazda C lamps those of 400 candlepower and larger are used almost invariably with a diffusing globe.

In outlying districts and residence streets it is generally desirable to redirect below the horizontal most, if not all, the light which otherwise would be wasted in the upper hemisphere. It has been customary to use relatively small illuminants in the lighting of such streets; thus it has come to pass that small incandescent lamps have been employed generally with reflectors, while magnetite lamps have been equipped with internal reflectors, both being designed with an eye to more successful utilization of the light in such outlying streets. More recently prismatic glassware has been adapted to accomplish the same purpose. This device —the refractor—is available in two forms. That used more largely consists of a bowl which redirects a large proportion of the total flux produced by a lamp. The other, known as the band refractor, is similarly constructed but does not modify the distribution of the light within a very considerable zone around the nadir. With the band refractor there is the usual flood of light on the street near the lamp which the bowl type of refractor does away with. In the principal urban business streets it is generally desirable to devote a part of the light from street lamps to the illumination of building fronts. In such streets, devices for directing all of the upper hemispherical flux below the horizontal are out of place. Furthermore, they are rarely necessary from the point of view of uniform street illumination, since in such streets the lamps should be spaced with sufficient frequency to produce illumination of ample uniformity.

One has only to devote a little attention to the development of illumination on the street in order to have his attention attracted to the theoretical desirability of asymmetrical light distributions which will direct the great bulk of the light along the street and allow less than the normal amount of light to fall upon the nearby buildings, trees or fields along the side of the street. Obvious and marked as are these theoretical advantages, attempts thus far made to supply such devices in practicable commercial forms have not proved successful. Whether this is to be taken as indicating that asymmetrical devices are not really needed or that the attempts have not followed practicable designs remains for the future to decide.

The tendency in design of accessories, fixtures, housings, etc., is strong in the direction of more ornamental and pleasing equipments. The Cleveland lantern illustrated herewith exemplifies the processes which more and more are coming to govern in street-lighting design, though their application may vary largely from that exemplified in this lantern. In this lantern a 1,000-candlepower Mazda C lamp (1,500 candlepower for most important locations) is surrounded by a band refractor with diffusing ribbings omitted, the whole being inclosed within the lantern, the panels of which consist of carefully chosen diffusing glass. The lantern is located only 15 feet over the curb and would produce a serious condition of glare were it not for its large size and the fact that the light distribution locates the maximum at an angle of 65 degrees while allowing sufficient light to be directed upward to illuminate building fronts to a modest degree.

The San Francisco triple lamp standard bearing three 6.6-ampere magnetite lamps, illustrated herewith, is another recent development indicating the tendency of modern street lighting of the first class. The pleasing contour and effective grouping of these units is evident. As they are located 30 feet above the street level, the resultant illumination is bound to mean a brilliantly lighted avenue, on which the buildings will stand out in great prominence, as is befitting an important thoroughfare.

Lampposts, too, are revealing the increasing public demand for artistic fixtures. The day of the cluster for street lighting appears to be past. The ornamental magnetite "white way lighting" struck a new note in design for this purpose and most of the newer installations in consequence are of the single-lamp type, whether the lamp be Mazda or magnetite.

"White way lighting," the expense of which has been borne by the business men rather than by the municipality, has brought out much adverse criticism from the technical point of view. Such lighting must be credited, however, with having promoted the demand for more adequate street lighting and with having extended the benefits of street lighting to small towns where formerly street lighting has not been practiced.

Installation Practice.

The use of ornamental posts for street lamps is of course contingent to a considerable degree upon underground distribution. Municipalities are none too eager to promote the adoption of underground systems at the added expense which it is necessary for them to bear in order to secure this improvement. The employment of steel-armored cable in outlying districts, parks, boulevards, etc., where the street is unpaved, facilitates the extension of undergronud distribution and makes possible the use of ornamental posts at a cost which is not prohibitively high. Its employment is one of the features of recent street-lighting practice.

The use of individual series transformers with each street lamp has been advocated recently. This offers some apparent advantages both in the way of increased flexibility in operation and protection of the lamp against line surges.

The design of some street-lighting fixtures for Mazda lamps necessitates the operation of the lamps tip upward. To meet this situation the manufacturers have designed lamps especially for such service. They are inferior to the standard lamps, however, in life.

RELATIVE LIGHT-PRODUCING EFFICIENCIES OF MAZDA C AND MAGNETITE LAMPS.

Mazda C Lamps.

Description	Bare Lamp			Equipped for service (assuming 25 per cent absorption in accessory)		
	Total Lumens	Average Watts	Lumens per Watt	Total Lumens	Average Watts	Lumens per Watt
6.6-amperes, "60-cp."	600	46.9	12.8	450	46.9	9.6
6.6-amperes, "100-cp."	1,000	71.9	13.9	750	71.9	10.4
6.6-amperes, "250-cp."	2,500	155.0	16.12	1,875	155.0	12.1
6.6-amperes, "400-cp."	4,000	245.0	16.32	3,000	245.0	12.2
6.6-amperes, "600-cp."	6,000	367.0	16.32	4,500	367.0	12.3
20-amperes, "600-cp." (compensator)	6,000	310.0	19.3	4,500	310.0	14.5
20-amperes, "1,000-cp." (compensator)	10,000	518.0	19.3	7,500	517.0	14.5
110-volt, "75 watts"	865	75.0	11.5	649	75.0	8.7
110-volt, "200 watts"	2,795	200.0	13.97	2,098	200.0	10.5
110-volt, "400 watts"	6,150	400.0	15.38	4,620	406.0	11.5
110-volt, "750 watts"	12,800	750.0	17.06	9,600	750.0	12.8
110-volt, "1,000 watts"	18,000	1,000.0	18.00	13,500	1,000.0	13.5

Magnetite Lamps.

Amperes	Description Electrode	Globe	Equipped for service Total Lumens	Average Watts	Lumens per Watt
4	Standard	Clear	2,991	310	9.65
4	High-Efficiency	Clear	4,649	323	14.4
5	Standard	Clear	5,768	390	14.8
5	High-Efficiency	Clear	7,655	371	20.6
6.6	Standard	Clear	8,708	511	17.0

Operation.

In earlier days the idea gained considerable prevalence that the candlepower of the lamps employed in street lighting was *the* important factor. It is now generally recognized that this factor is of no greater importance than good appearance of fixtures and lamps and posts, cleanliness, good maintenance, reliability of service and the numerous other conditions that go to make a good street-lighting service rendered to the municipality. Emphasis upon each of these factors in the operation of street-lighting systems is coming to be regarded more and more as important.

Illuminating-Engineering Aspects.

In a general way it has been observed as the result of experience that, other things being equal, street lighting is good when many lamps are installed at frequent intervals and that it is poor when few lamps are installed at great intervals. It has also been observed that lamps having concentrated downward distribution are not quite so effective, other things being equal, as lamps delivering more light at angles somewhat farther up toward the horizontal. Both these conditions of superiority have involved a closer approach to uniformity of light distribution along the street than was had under the conditions of inferiority against which they have been contrasted. Largely upon this basis it has become almost an accepted dictum of illuminating engineering that uniformity is a first desideratum in street lighting. Thus an ideal for street lighting has been formed without trial and possibly without consideration of the other factors which would be likely to be involved in the effort to secure uniformity. For years uniformity has been held up as the important end to be attained in street lighting and has been attained or approached only through the installation of lamps so closely spaced that without disturbance of their natural light-distribution characteristics, the desired end was attained. Under these conditions no occasion arose to question the desirability of uniform street lighting, such illumination being eminently satisfactory. Recently, however, the development of the refractor has made possible the attainment of uniformity in street lighting by distortion of the light-distribution characteristic of illuminants giving the desired effect with relatively wide lamp-spacing intervals. In a few cities this type of lighting has been indulged in upon a considerable scale, so that for almost the first time it has been possible to study so-called uniform lighting and to appraise its value. Uniform lighting is generally taken to mean uniform distribution of horizontal illumination intensity along the street. Such lighting so obtained is found to suffer from certain undesirable qualities as follows: The intensity of the light distributed just below the horizontal is much increased and as the refractor or the apparent source is relatively small, the result is excessive brightness at angles certain to produce deleterious glare. By reason of the same distribution characteristic the proportion of light delivered within relatively narrow zones upon building fronts, trees or fields is large, and the proportion of light delivered upon the street is relatively small. Wherever such lighting is employed on business streets bounded by important buildings, the lighting effect on the building fronts is most displeasing, due to the eccentric distribution. Last but not least, the ordinary refractor secures an increase in the light delivered somewhat below the horizontal by robbing the street in the neighborhood of the lamp of that strong intensity which is so important to the excellence of the general illumination on the street.

Fig. 1.—Cleveland Lantern.

Fig. 2.—San Francisco Standard.

At the present time there is considerable diversity of opinion as to the illuminating-engineering theory of street lighting. It must be recognized, however, that street lighting has suffered much more from excessive non-uniformity than it has from uniform distribution of light, and that if in a few instances the pendulum swings too far in the direction of uniformity, the final result will probably be salutary in assisting to bring general practice to that point between extremes which will be found to be sound both theoretically and practically. The writer is one of those who believes that uniformity of horizontal illumination on the street is not the most important consideration and that it should not be had by an excessively great departure from natural distribution of light. A moderate diversity of illumination, avoiding on the one hand dark areas between lamps and on the other hand that close approach to uniformity which is demanded by certain engineering theories rather than by practical considerations, will be found to be most advantageous wherever effectiveness is measured by the success with which the street lighting serves the purposes for which it is designed. Thus the present-day tendency may be said to be toward a closer approach to uniformity in street lighting.

The difficult and complicated subject of glare continues to receive attention. The principles underlying the operation of this effect are fairly well understood, though their application is rather indefinite to any particular installation. In general the illuminating-engineering view conforms with the teachings of experience in regard to glare mitigation and the use of diffusing globes with the mounting of lamps moderately high in relation to their candlepower continues to be approved practice.

Conclusion.

Generalizing, an inspection of the record of the past two or three years in street lighting together with consideration of the present-day status of the art indicates sound tendencies, including the use of the most efficient illuminants on artistic fixtures and posts equipped with suitable accessories. Also, there is an increasing tendency toward skillful application of these materials of illumination in such a manner as to utilize in a reasonably satisfactory way a large proportion of the light which is produced.

ELECTRICAL CONSTRUCTION

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

Evidence for Prosecution of Non-Licensed Workers Asked For.

The Electrical Contractors' Association of Massachusetts is appealing to its members to support its special representative, J. E. Wilson, in the pursuance of his duties, by backing him up in his efforts to prosecute cases of non-compliance with the licensing law. Complaints come to him from members and others that someone in their city is conducting business or working without holding a license. Such cases receive prompt attention, but when the representative visits the city he finds the complainant loath to appear in court and bring evidence against the offender. Many contractors say: "I cannot afford to have my name appear in this matter, as some of his friends are mine also," etc.

Despite the handicap, all cases coming under the representative's notice have been satisfactorily disposed of, the party either obtaining a certificate or quitting work.

West Virginia Requires 660-Watt Sockets.

After due consideration of the tendency toward increasing use of electrical appliances of all kinds, the Electrical Inspection Bureau of West Virginia has required the use of 660-watt sockets or 660-watt receptacles in all places where electrical appliances are likely to be used. The following notice, signed by Electrical Inspector A. K. Brake, of Wheeling, W. Va., was recently mailed to electrical contractors:

"The new 1915 Code permits the connection individually of small motors (¼ horsepower or less), electric irons (660 watts or less), and small heating devices in general (660 watts or less) to lighting circuits under certain conditions, and due to the fact, first, that the above-named devices will sooner or later be used quite generally, and second, that the additional cost necessary to prepare equipments for the attachment of these devices is now practically negligible, this office shall, on and after April 1, require that equipments in all residences, flats, millinery establishments, meat shops, grocery stores, and the like, shall be installed with approved receptacles for the attachment of the above named devices, whether same are to be present or not. Estimates for wiring should take into consideration these conditions.

"The requirements for the above are as follows:

1. Each circuit must be protected with fuses not larger than 10 amperes.
2. The normal load in use at any time upon a circuit must not exceed 660 watts. Where lights are so located that they are likely to be used at the same time the motors or heating devices are in use, the number of sockets on lighting circuits must be reduced accordingly.

"In larger residences, install a special circuit supplying the basement, kitchen and dining room, and provide on this circuit approved receptacles—at least one in each room—for the attachment of the devices above mentioned. In ordinary residences the special circuit may include the entire first floor and basement, and in quite small residences one circuit for all floors will be satisfactory. In all residences these special circuits should not have more than ten sockets each. Approved receptacles in all cases shall be interpreted to mean either 660-watt baseboard or floor receptacles, or 660-watt sockets. Reinforced No. 16 drop cord must be used for drops for 660-watt sockets, and No. 16 heavy insulated wire must be used in fixtures for 660-watt sockets.

"In stores, shops, etc., where just one iron or motor or other heating device is to be used, install wiring same as in residences, but where more than one device is likely to be used, install a special circuit with approved receptacles for each 660 watts of power likely to be used, and protect each circuit with fuses and not larger than 10 amperes.

"Motors larger than ¼ horsepower and all heating devices larger than 660 watts must not be attached to lighting circuits, but must have separate circuits each, provided with separate fuses and switches."

Replacing Street Lamps from the Ground.

The accompanying illustrations show a novel form of "Home-made" instrument used for removing and replacing street lamps by the Texas Power & Light Company at Paris, Tex.

By means of a small rope the jaws of this instrument are held open so that a hold can be secured on the lamp. The

Home-Made Lamp Adapter for Removing and Replacing Street Lamps.

spring serves to hold the lamp fast after it has been caught in the holder.

Twenty-five lamps were replaced in two hours by one man using this method.

Soldering Small Parts.

For soldering small instrument parts without extra heating, I take a piece of copper wire and file it to a point and heat and tin it the same as any ordinary soldering copper. This tool is better than the smallest-size soldering copper for very small work. The size of wire used in place of a soldering copper can be made suitable to the particular work at hand.

M. J. Moriarty.

Polyphase Motor Windings—V

By Justin Lebovici

In discussing polyphase motor windings the author first took up closed two-layer windings, elucidating the presentation with examples and illustrations. This was followed with a consideration of open windings, which is continued in the present installment, attention being here given to a special case of lap winding. The examples cover both two-phase and three-phase machines. The next installment will explain simple methods of checking winding diagrams. In future installments single-layer windings and windings for two speeds will be taken up and special attention given to the mechanical design of windings and to insulation.

Lap Windings with a Whole Number of Slots Per Pole and Phase.

The arrangement of the conductor diagram for a full pitch winding is very simple and is shown for the case of two-phase, one slot per pole and phase in Fig. 53. The full lines indicate one phase and the dotted lines the other phase. In case there

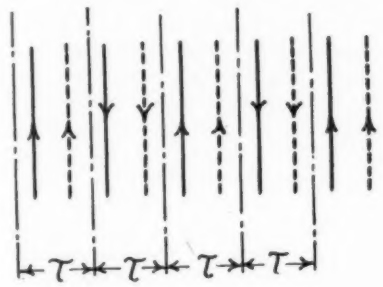


Fig. 53.

are 9 conductors per pole and phase we will have per pole pitch 9 full lines and 9 dotted lines.

Fig. 54 shows the conductor diagram for a full-pitch three-phase winding with three conductors per pole and phase. We distinguish the phases by a heavy line, a light line and a dotted line.

The conductor diagram for a short-pitch winding is not as

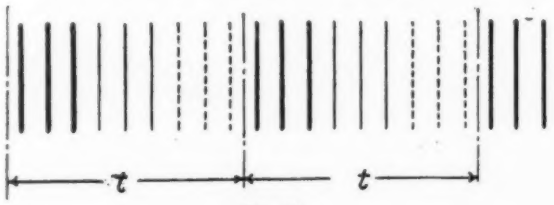


Fig. 54.

simple and then it is easier to start from the closed winding, as will be explained by the following examples.

Having the conductor diagram, we can consider each phase as a single-phase winding and proceed as has been explained in the part dealing with single-phase windings.

Example No. 20.

Given a 24-slot ($Z=24$) stator core, it is proposed to lay out the winding diagram for a four-pole ($2p=4$), two-phase ($n=2$) winding. There are 24 coils, or two coils per slot ($y_n=2$).

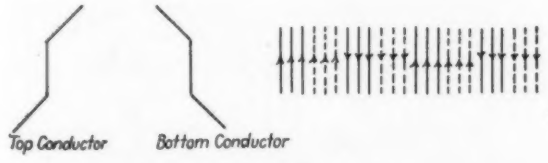


Fig. 55.

The winding is to be full pitch. Call the number of slots per pole Q and the number of slots per pole and phase q. Then we have:

$$Q=Z/2p=24/4=6 \qquad q=Q/n=6/2=3.$$

We can lay out the conductor diagram shown in Fig. 55 and proceed to connect up each phase as explained in connection with the single-phase windings. At the left of the figure is shown the distinction between the top and bottom conductor. Fig. 56 shows the conductor diagram, Fig. 55, connected up to a single plus or two-phase, four-wire, single-circuit open winding.

In practice it is usual to have the coils form-wound or spread

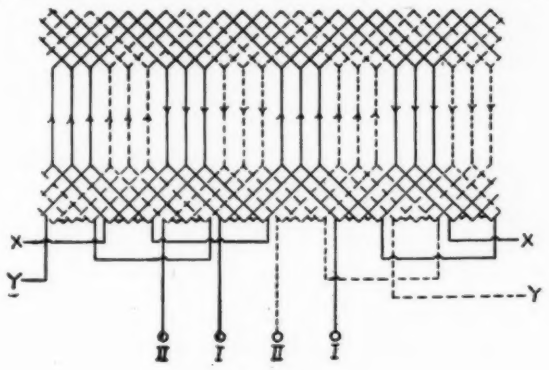


Fig. 56.

to certain dimensions, the shop being informed to lay the coils in certain slots. In the case of Fig. 56 it would be stated that the coil lies in slots 1 and 6. After the coils are all placed in the slots, the person connecting up the winding is only interested with the bottom part of Fig. 56 as shown in Fig. 57. Fig. 57 has the advantage that it holds for any coil pitch.

One method of dealing with a short-pitch winding would be to lay out the full-pitch conductor and connection diagram as shown in Fig. 56 and then use only the part shown in Fig. 57 for the connections between coils and groups. The actual pitch of the coil can be given in a separate instruction to the winding room.

The arrows in Fig. 57 indicate the direction of flow of current from coil to coil in the different groups and present an easy means for checking up winding diagrams. In bringing out the leads the following precaution should be taken. Referring to Fig. 36, we see that the phases I and II are displaced in space by 90 electrical degrees. Since one pole pitch is equal to 180 degrees, we have:

180° corresponds to $\tau=Q=6$ slot pitches,

90° corresponds to $6\times90/180=3$ slot pitches,

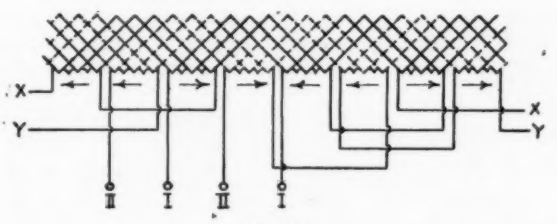


Fig. 57.

and the leads must be brought out in such a manner that there are three slot pitches between the groups belonging to the same phase.

Arranging the arrows in Fig. 57 around a circle we obtain a very useful and common representation of this type of wind-

ing. This has been done in Fig. 58. The small figure under each arc indicates the number of coils in the section or group. The number of groups or sections is equal to $2pn$ in the case in hand ($2pn=2\times2\times2=8$) and we have to divide the circle in eight parts in order to show the winding given by Fig. 57. The figures 1_s and 1_f represent the start and finish leads of each group. n consecutive groups in Fig. 58 carry a clock-

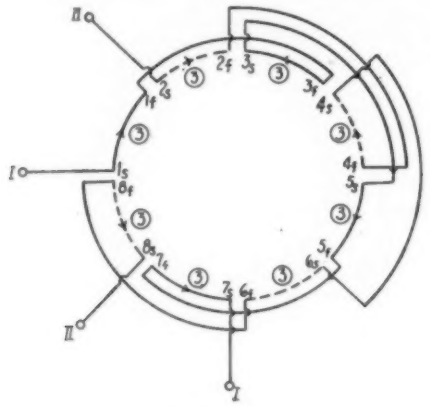


Fig. 58.

wise arrow and the n following groups a counterclock arrow. Starting with one group we follow the groups in the same phase in the direction of the arrow.

It is sometimes the practice to give separate instructions regarding placing the coils in the slots and grouping the coils and give instructions for connecting up the groups in the form of a table based on the tagging of the group leads, as shown in Fig. 58. Such a table is given below for the winding diagram shown in Figs. 56, 57, 58.

TABLE XIII.

Io	—	1_s	—	1_f	—	3_f	—	3_s	—
		5_s	—	5_f	—	7_f	—	7_s	— oI
IIo	—	2_s	—	2_f	—	4_f	—	4_s	—
		6_s	—	6_f	—	8_f	—	8_s	— oII

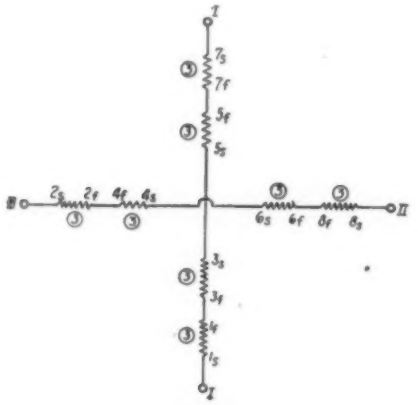


Fig. 59.

The representation shown in Fig. 59 of the same winding is sometimes useful, since it shows at a glance what otherwise would have to be given in form of notes. Fig. 60, Table XIV, and Fig. 61 show conductor diagram Fig. 55 connected to a double plus or double-circuit, two-phase, four-wire system.

Fig. 62 is the same as Fig. 60, except the sections are so ar-

TABLE XIV.

Io	—	1_s	—	1_f	—	3_f	—	3_s	— oI
		7_f	—	7_s	—	5_s	—	5_f	
IIo	—	2_s	—	2_f	—	4_f	—	4_s	— oII
		8_f	—	8_s	—	6_s	—	6_f	

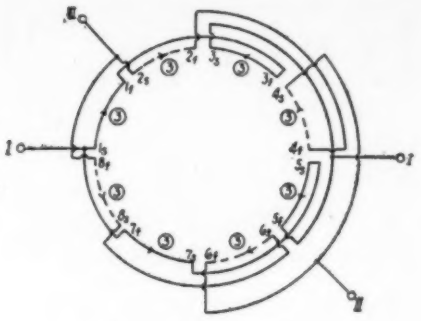


Fig. 60.

ranged as to reduce the unbalanced magnetic pull to a minimum.

It can be easily seen from Fig. 61 that starting from lead I the potential rises to the same value when the points 1_f and 7_s are reached. In other words points 1_f and 7_s are points of equal potential, or equipotential points, and can be strapped across as shown in Fig. 61. The same thing is true of points 2_f and 8_s. The effect of this cross-connection is that the current distributes itself more evenly around the core, resulting in a reduced unbalanced magnetic pull and reduced noise.

Example No. 21.

Given a 16-slot ($Z=16$) stator core, it is proposed to lay out the winding diagram for a two-pole ($p=1$), two-phase ($n=2$), short-pitch winding. There are 16 coils ($y_n=2$) to be placed in the slots and connected up. Since the winding head or

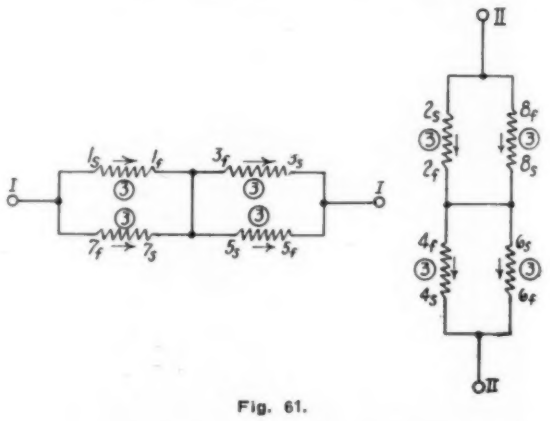


Fig. 61.

coil protrusion of a two-pole arrangement extends out farther than the usual bracket will accommodate, it is often found practicable to use a coil pitch corresponding to a four-pole machine and correct the ends as in a two-pole winding.

We have $Z=16$ $S=2\times16=32$.

Pole pitch corresponding to four poles $\tau=32/4=8$ and $y_1=\tau=4y_n+1=4\times2+1=9$, $y_2=y_1-2=7$. Table XV gives the ar-

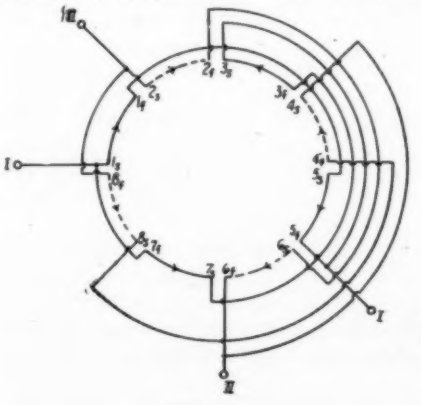


Fig. 62.

rangement for the closed winding which can be cut in places and connected to form the open winding desired. It is clear

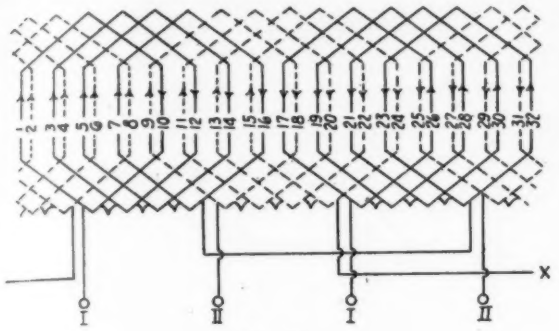


Fig. 63.

from Fig. 37 that each section will have 32/4=8 coil sides, and we obtain as leads the conductors indicated in Table XV.

TABLE XV.

Io— 1—10	IIIo—17—26
3—12	19—28
5—14	21—30
7—16—oI	23—32—oIII
IIo— 9—18	IVo—25— 2
11—20	27— 4
13—22	29— 6
15—24—oII	31— 8—oIV

The sections can be cross-connected according to one of the schemes shown in Fig. 38, 40, 41 or 42. Fig. 63 is a graphical

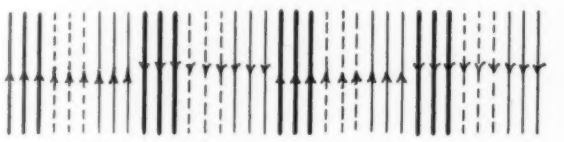


Fig. 64.

representation of Table XV connected to a single plus winding according to Fig. 41. As has been explained in connection with single-phase windings, the resulting electromotive force of a coil and the electromotive force per phase can be obtained by considering the coils as full-pitch coils and multiplying the resulting value of electromotive force by the factor f_p. For full pitch in the above example the coil would lie in slots 1 and 9; actually the coil lies in slots 1 and 5 and we obtain

$$\beta=(9-5)\times 90/8=45^\circ$$

or $f_p=\cos\beta=\cos 45^\circ=0.707$.

We note in Fig. 63 that over a considerable portion of core the currents in the same slot buck each other, thus considerably reducing the leakage around the slot, a fact which will be considered later.

Example No. 22.

Given a 36-slot ($Z=36$) stator core, it is proposed to lay

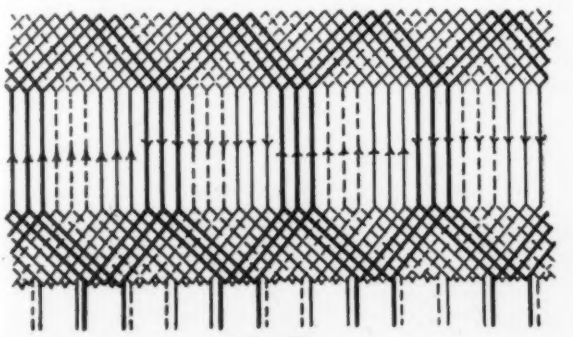


Fig. 65.

out the connection diagram of a four-pole ($p=2$), three-phase ($n=3$), single star, 36-coil ($y_n=2$) winding.

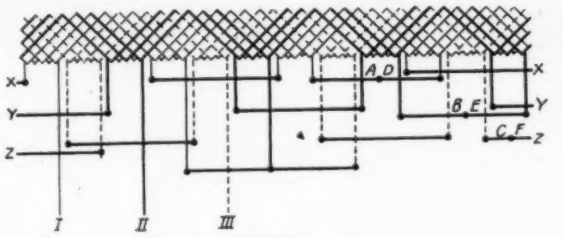


Fig. 66.

We have slots per pole, $Q=36/4=9$.

Slots per pole and phase, $q=Q/3=3$.

We can at once lay out the conductor diagram for a full-pitch winding as shown in Fig. 64. Considering every phase as a single-phase winding, we can proceed to connect the conductor according to the rules developed in connection with the single-phase windings. There will be leads left over which can be connected according to Fig. 46. This has been done in Fig. 66. Fig. 66 represents the part of Fig. 65 in which the winder making the cross-connections is actually interested. Fig. 67 and Table XVI convey the same information as Fig. 66, but represent somewhat different shop practice. Figs. 68,

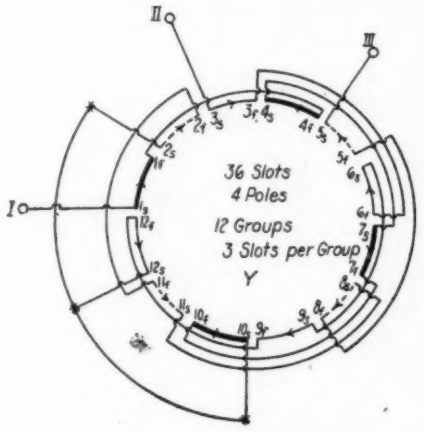


Fig. 67.

69 and Table XVII show the arrangement of conductor diagram Fig. 64 when the same is to be connected for a two-circuit star in line with Fig. 47.

TABLE XVI.

Io—1s—1t—4t—4s—7s—7t—10t—10s—

IIo—3s—3t—6t—6s—9s—9t—12t—12s—

IIIo—5s—5t—8t—8s—11s—11t—2t—2s—

Fig. 70 and Table XVIII show another arrangement of end connections for double-circuit star winding, which has the advantage of leading to a smaller unbalanced magnetic pull than Fig. 68, although the connections between groups are longer.

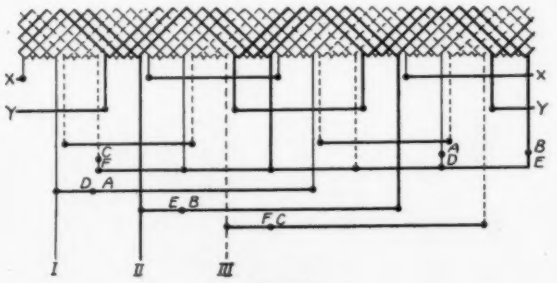


Fig. 68.

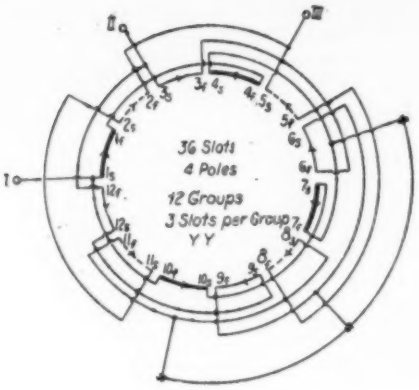
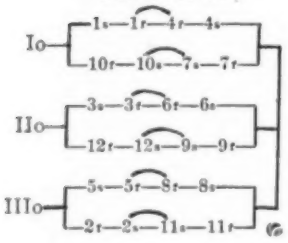


Fig. 69.

TABLE XVII.



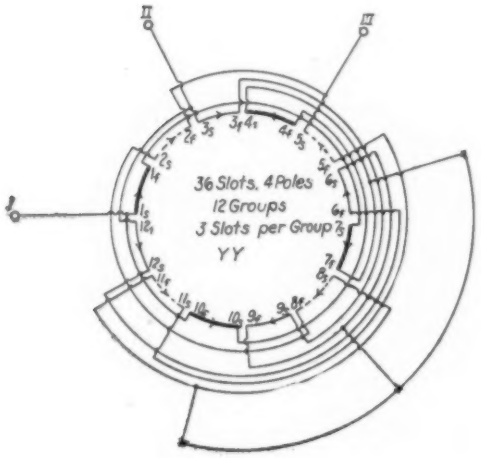


Fig. 70.

TABLE XVIII.

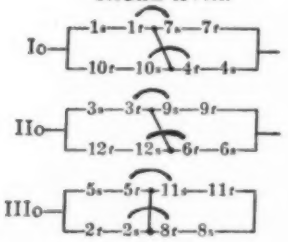


TABLE XIX.

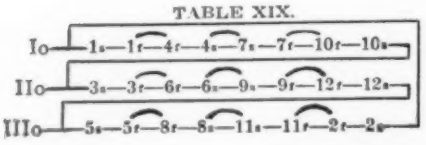


Fig. 71 and Table XIX show conductor diagram Fig. 64 connected to a single delta as per Fig. 49. Tables XX and XXI give the same winding connected to a double-circuit delta.

If six leads are brought out from the winding resulting out of conductor diagram Fig. 64, the machine can be connected either star or delta and the change from one winding to the

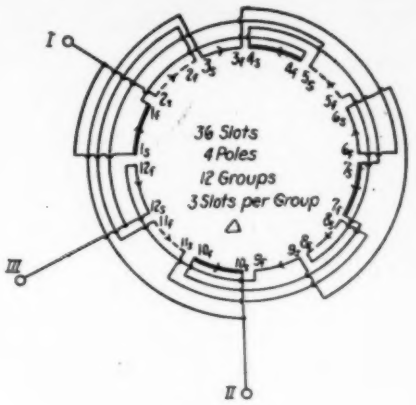
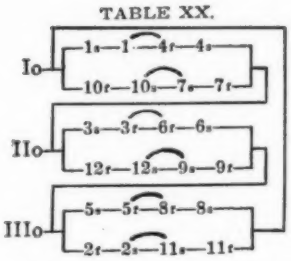


Fig. 71.

TABLE XX.



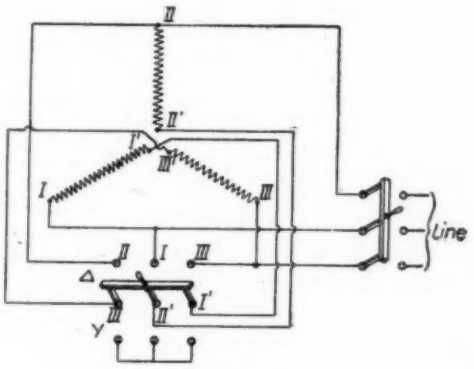


Fig. 72.

TABLE XXI.

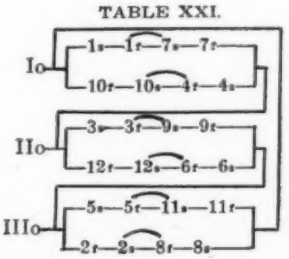
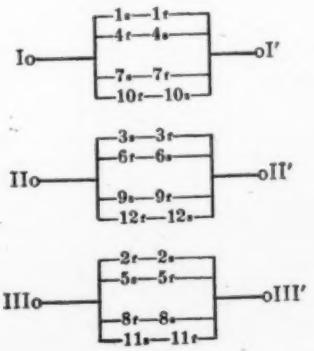


TABLE XXII.



other can be accomplished by a double-throw switch as shown in Fig. 72.

In the double-circuit winding given, for example, in Table XVIII, the leads 1_7 and 10_8 have the same potential and can be permanently strapped across, similarly 3_7 and 12_8 and 5_7 and 2_7. Such connections in multiple-circuit winding may help materially to reduce eccentric magnetic pull and noise.

Table XXII shows the connections for conductor diagram Fig. 64, connected to a four-circuit winding, there being six leads brought out, allowing the winding to be connected either star or delta.

(To be continued.)

Correction.

Mr. Lebovici has called the editor's attention to the fact that the arrangement of several of the tables in the issues of August 12 and 19 was not as intended by the author. The tables are reproduced herewith with proper arrangement, corresponding to the rotation of the conductors in the diagrams. The tables originally appeared on pages 292, 293, 295 and 335.

TABLE IV.

Commutator Segment.	Conductor.	Conductor.	Commutator Segment.	Conductor.	Conductor.
■ 1	1	6	6	11	16
2	3	8	□ 7	13	18
■ 3	5	10	8	15	2
4	7	12	9	17	4
□ 5	9	14			

TABLE V.

Commutator Segment.	Conductor.	Conductor.	Commutator Segment.	Conductor.	Conductor.
■ 1	1	6	5	9	14
9	17	4	4	7	12
■ 8	15	2	3	5	10
7	13	18	2	3	8
6	11	16			

TABLE VI.

Commutator Bar.	Conductor.	Conductor.	Commutator Bar.	Conductor.	Conductor.	Commutator Bar.	Conductor.	Conductor.
■ 1	1	6	6	11	16	11	21	26
2	3	8	7	13	18	12	23	28
■ 3	5	10	8	15	20	13	25	2
4	7	12	9	17	22	14	27	4
5	9	14	10	19	24			

TABLE VIII.

Commutator Bar.	Conductor.	Conductor.	Commutator Bar.	Conductor.	Conductor
■ 1	1	10	□ 10	19	28
3	5	14	12	23	32
■ 5	9	18	□ 14	27	4
7	13	22	16	31	8
□ 9	17	26	■ 2	3	12
11	21	30	4	7	16
□ 13	25	2	■ 6	11	20
15	29	6	8	15	24

TABLE XI.

Commutator Bar	Coil Side.	Coil Side.	Commutator Bar.	Coil Side.	Coil Side.
A_2 —— 1	1	12	11	21	32
21	41	10	10	19	30
20	39	8	9	17	28
19	37	6	B_2 —— 8	15	26
18	35	4	7	13	24
17	33	2	6	11	22
16	31	42	5	9	20
C_2 —— 15	29	40	4	7	18
14	27	38	3	5	16
13	25	36	2	3	14
12	23	34			

Activities of Philadelphia City Electrical Bureau.

The city of Philadelphia, Pa., has as one of its principal departments of municipal activity an Electrical Bureau, of which J. F. McLaughlin is the present chief. The functions of the Bureau comprise the lighting of the streets, parks and public buildings; the maintenance of the fire-alarm and police-call systems; the wiring of city buildings; underground construction; and the care and operation of the City Hall lighting plant, from which its lighting and power supply are derived.

The chief of the Bureau has recently devised a chart, which graphically represents the organization of the Bureau, with its various divisions of work which center in the executive offices, and shows the location, on a map, of the fire stations, pumping stations and police quarters throughout the city. There are in Philadelphia 874 police patrol boxes, 2,232 fire-signal boxes and 1,920 police telephones. A map of the city, constructed of heavy pulp board about 7 by 10 feet, is located on the wall of the executive office, and represents graphically by means of colored pins, the location of the 45 district police station houses, the 82 fire houses, and the 190 high-pressure boxes, besides the fire-signal and police-patrol boxes noted above. A series of ward maps, 48 in all, showing in detail, also by means of pins with heads of various colors, the location of the nearly 16,000 municipal arc lamps, are being made. These ward maps will be six by four feet in size and incased in wooden frames, and will be swung on trunnions from the office wall.

Experiments in street lighting with type C Mazda units are now being carried on and the installation of magnetite arc lamps, in place of the present open arcs, is being considered. A rearrangement of street lighting on the Northeast Boulevard is about to be made. The present lamps are on 22-foot poles. Since being installed, the roadside trees have grown to such an extent that the branches obstruct the light both on the streets and the sidewalks. The lamps will be lowered to 14 feet above the roadway and placed on arms which will carry them over the highway. About 15 new units will be installed at approaches to bridges, with the special intent of lighting the guard rails so as to prevent faulty turns by automobile drivers.

In this connection, the flood lighting of streets by means of projectors is being experimented with in the desire to do away with dark spots under trees, now inevitable on either the street surface or else on sidewalks, in whatever location the street lamps may be placed. Experiments with ground-area lighting by means of projectors were made during a recent convention of advertising men, when excellent results were obtained.

The flood-lighting installation on the City Hall tower is by means of 300 500-watt concentrated-filament units in General Electric and X-Ray reflectors.

It is now proposed to floodlight the front of the *Evening Bulletin* Building, which is about 225 feet northeast of the City Hall. Eight 500-watt projectors will be installed on the northeast corner of the municipal building and the city Electrical Bureau will install the apparatus and furnish energy from the City Hall plant, the *Bulletin* company to reimburse the city for the outlay, and for the cost of lighting, which will be about $300 per year, the energy generated at the municipal plant costing about three cents per kilowatt-hour.

In this connection the head of the Bureau points out that the idea of flood lighting the City Hall tower originated in 1908, when seven arc searchlights in 16-inch projectors were installed, part on the roof and part on neighboring buildings. This was in connection with Founders' Week celebration.

Among the Contractors.

The Denver Electrical Company, Fifteenth Street and Cleveland Place, Denver, Colo., of which Clark Rider is president, has been awarded the contract for wiring and supplying lighting fixtures for the new Webber theater that is to be built in South Denver. The exterior of the theater will be lighted by a flood-lighting system, while the interior will have a semi-indirect system. When completed the building will be the best lighted theater in Denver, according to present plans.

The Shadley Electric Company, electrical contractors, and Henry J. Boese have opened shops and offices at 712 Wyandotte Street, Kansas City, Mo. Mr. Boese was formerly superintendent of shop for the Squire Electric & Construction Company. He will specialize in electrical repairs.

THE DEALER AND STOREKEEPER

An Exchange of Ideas and Experiences on Advertising and Selling Methods, and Store-Keeping for the Dealer in Electrical Goods

BASIC PRINCIPLES OF MERCHANDISING EXHIBITED BY LIGHTING-FIXTURE CONCERN.

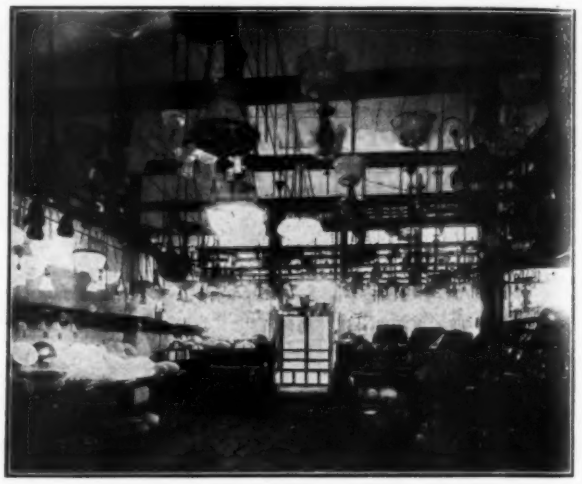
Success Attributed to Good Business Methods, Well Appointed Showrooms and Complete Stock of Fixtures.

To broad merchandising policies, attractive salesrooms and a complete stock of electric-lighting fixtures can be attributed much of the success of Samson & Company, of Chicago, Ill. This firm occupies the main floor, basement and part of the second floor at 28 West Lake Street. The store is 27 feet wide and 140 feet deep.

The entrance is arranged to give two show windows of unequal length, which, while shallow, are used very effectively for exhibiting lighting units. Displays are changed weekly, and a moving element can usually be seen in one of the windows. The main salesroom occupies the front half of the store. In this room are displayed about 200 ceiling-type lighting units, and a large number of wall brackets, semi-indirect globes, portable lamps and samples of fixture glassware. The ceiling-type units are hung from a wooden framework which is suspended by chains from the 15-foot ceiling at a height of nine feet three inches. Each of these fixtures can be illuminated, the circuits being controlled by pendant snap switches. On seven tables near the front part of the store are displayed the portable lamps, numerous styles being shown.

For exhibiting the semi-indirect globes a rather unique table is used. It is shown at the left in the accompanying illustration, and is 18 feet long and three feet wide. Only a part of the table top is level, one part being inclined to the horizontal at an angle of 15 degrees, another part being inclined at about 30 degrees. The level part extends along the table and is about 16 inches wide. The second inclination is the same width and the third about 12 inches wide. Flush with the top of the table are distributed 43 outlets, each outlet being controlled by a snap switch and containing a 25-watt tungsten lamp. Over each lamp is placed a semi-indirect globe for exhibition purposes. The inclinations are separated by a rib about half an inch high and against which the globes on the slant are rested. The table serves very well for showing customers how the globes appear when illuminated and offers opportunities for comparison. Then, too, a globe displayed under the table can be illuminated by the salesman merely exchanging it for one on the table. The table is made of wood and is an inexpensive means of showing a comparatively large number of globes in a small space.

Exterior of Samson & Company's Store.



A View in the Main Salesroom.

In the rear part of the main salesroom are the offices of the company and beyond these are three separate display rooms, each 12 by 14 feet, with 9-foot ceilings. These rooms have compoboard ceilings and paneled walls, and are tinted with Tiffany finish. The first room contains 26 styles of semi-indirect ceiling-type units, a rug, table, chairs, bookcase and a few portable lamps. The second and third rooms contain similar furnishings, except in the second are exhibited types of pendant shower units and in the third pendant candle-type units. Each of the fixtures in these rooms can be illuminated and readily admits of comparison. There are over 1,000 outlets in the main salesroom and the three showrooms.

A balcony extends over the showrooms and part of the salesroom and is used for displaying domes and storing glassware. The basement is used for storing the major part of the stock of glassware, both sold and unsold. There is a system of shelving for storing the unpacked glassware and facilitating the filling of orders. Additional space is being used in an adjoining basement for the storing of glassware.

The rear of the first floor and a large part of the second floor is used for storing metalware and for assembling the lighting units. Here, too, are kept the packages of orders made up ready for installation.

Perhaps the most insistent appeal Samson & Company makes to the public is the recommendations of its cus-

tomers—a merchandising power which is at the same time satisfactory and inexpensive. Display windows and location of the store are important factors in the volume of sales. Neat and attractive window displays bring much trade, and the fact that the store is in Lake Street—sometimes called fixture-store row—also helps materially in bringing customers inside the store. But these two merchandising factors will not satisfy any progressive dealer's ambition. For some time it was the concern's custom to advertise quite extensively in the daily newspapers. Some trade was secured in this way, but the results were not altogether satisfactory. Advertising pays, certainly, but the volume of business could not assume the proportions expected through this single additional medium.

Going down to basic principles, it was felt that a large list of customers perfectly satisfied with the fixtures sold them, the treatment given, the service rendered, and the prices paid, would bring more trade than any other means, and that is the method pursued by Samson & Company. In the first place, the business is on a cash basis; that is, the customer pays a deposit on the order and the balance when the fixtures are installed. This policy reflects to the customers' benefit because it insures a less expensive cost of doing business for the dealer. It is estimated that a dealer turning over $30,000 worth of stock in a year on a credit basis will lose $2,000 to $5,000 on poor accounts, through those actually lost and the cost of collecting the others and of bookkeeping. The dealer simply does not pocket this money; instead, the customer receives some benefits gained in this way—he gets more value for his money. And if it requires something more than mere order-taking to secure a sale the customer is informed convincingly that the concern's methods of doing business are bound to save him money. It is a service given to the customer.

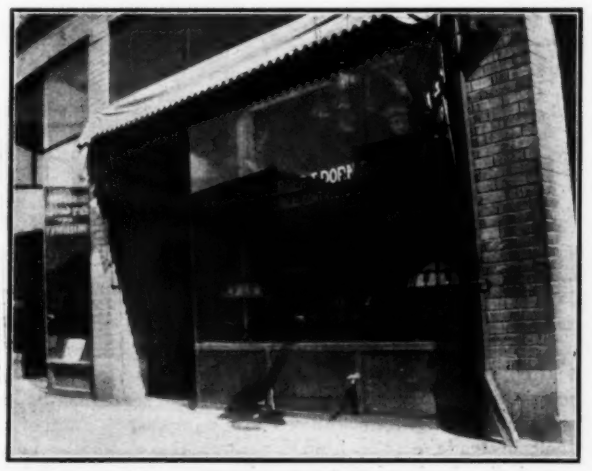
When a sale of fixtures is made two tickets are made out—one called a shop ticket and one a glass ticket. The shop ticket specifies the styles of fixtures and the number of each ordered. The other ticket specifies the glassware selected by the customer. The shop ticket reaches the hands of what is called a "condition" man, whose duty it is to take the ticket to the customer's house and find out if the order has been correctly made; that is, he ascertains if the number of fixtures ordered corresponds with the number of outlets, if a certain fixture when installed will interfere with the opening of a door, if there is a wall switch in the dining room that the customer has ordered a semi-indirect unit for, and similar details. In other words, he goes over the conditions under which the installation is to be made, and reports the discrepancies. If any exist the customer is informed—a service that is in many instances fully appreciated by him, and he realizes that he has purchased something more than so many fixtures for a certain number of dollars. That something more is the experience and expert opinion of men who do nothing else but make lighting-fixture installations. The "condition" man, on his inspection of the building, takes into the consideration the appropriateness of the fixtures ordered, and if it is his opinion that they will not correspond to the decorations, room sizes, etc., the customer will be told, with the suggestion that he should come to the store and talk the matter over and possibly make a second selection. Precaution and tact are used to make the customer realize that the suggestions are entirely for his benefit and not the dealer's.

With the assurance that the shop ticket is correct, the order is made up and packed, each package being labeled with the purchaser's name and the street number of the building in which it is to be installed. Correspondingly, the glass ticket is corrected, if necessary, and the glassware packed and labeled. The fixtures are then stored, available the minute they are needed for installation. This system can be maintained because the company has a stock of metalware estimated to cost $15,000 to $18,000 and a stock of glassware of about the same value. Obviating the delay in securing fixtures when they are needed and the necessity of substitution is a real service to the customer, one that may well be illustrated. The company has secured a number of orders from a certain builder because of this service. A year or so ago this builder erected a large apartment building, and could not obtain all the glassware for the lighting fixtures because the dealer was unable to obtain prompt delivery from the manufacturer. Rooms without complete lighting fixtures did not appeal to prospective renters, and the builder was quick to remedy the trouble, and now makes his purchases from dealers who can guarantee delivery.

Another service offered to customers is supervision of the installation of lighting fixtures. Many small complaints that would rankle in the heart of a purchaser and which are retained and not registered with the dealer can be tended to before they are ever made by careful supervision. The lack of complaints becomes evident to the customer in time and is an added reason for recommending the dealer who installed his fixtures. It is the policy of Samson & Company to take as much care in the interest of the customer as in selling an order. Fixtures are guaranteed not to develop any mechanical defects within a period of two years, replacement being made if any do develop. The customer is so informed, the company lives up to the guarantee, and makes what few replacements there are with good grace, something dealers in general find hard to do, but which under all circumstances is the proper and trade-bringing attitude to assume if the guarantee is a true one.

Backing Up Effective Window Displays With Attractive Interior Arrangements.

The firm of Nollenberger & Dorner, electrical contractors, 1408 Stout Street, Denver, Colo., carries a line of electric-lighting fixtures and believes the best way to attract attention to their stock is by simple but effective window displays. Backing this up the interior arrangement of the



Show Window of Denver Lighting-Fixture Concern.

lighting fixtures is attractive and displayed in such a manner as to allow of close inspection and comparison.

A large number of fixtures are hung from the ceiling, while other lighting units are displayed on shelves and tables. The walls of the store are utilized in displaying bracket fixtures.

The Nollenberger & Dorner store is very attractively arranged and throughout is well in keeping with what a store of its kind should be.

A Modern Lighting-Fixture Store in Louisville

Experience, Taste, Judgment and Sound Merchandising Policies Have Made the Burdorf-Brecher Company's Store in Louisville, Ky., a Model One With Thoroughly Modern Characteristics

WHAT many a retailer dealer in electric-lighting fixtures has often dreamed about doing with his store the Burdorf-Brecher Company, 433 West Jefferson Street, Louisville, Ky., has done with its place. It represents the results of long experience, enterprise, artistry and all-round good merchandising. In many respects this store may serve as a model for others engaging in the same business, or various features of it could be incorporated in the lighting-fixture departments of houses handling this stock as a side issue to the main business.

The Burdorf-Brecher Company is a specialist on lighting fixtures, although the line is one of several handled. Combined harmoniously with the lighting-fixture business are the kindred household decoration lines, of mantels, tile and fireplace accessories. It is a happy association. No matter what a customer comes into the store for, he is at least a potential prospect for a sale of something other than the line which includes his immediate wants. If it is a mantel that is wanted the customer's attention is directed to the display of overmantel bracket lamps at the same time he looks at the mantel displays. The same is true of tiles and fireplace fittings, while the customer looking for a lighting fixture or a series of them will at the same time be pleasantly reminded of other household needs and will go away with the impression that here is a good place to fill them.

The lighting-fixture line is the major line, at least so far as the display is concerned. Samples are shown in the display windows in connection with showings of mantels, tiles and fireplace fittings. This combination heightens the effect created by any or all of the items shown, especially when the arrangement is well thought out. The reception room further emphasizes the fact that the lighting fixtures are a principal part of the stock in trade of the house, and as the customer moves toward the back of the store lamps and fixtures of one kind or another keep prominently before the eye the fact that there is the place to buy them.

As to the building itself, it is not out of the ordinary, being one of the older class of stores and long occupied by the Brecher-Buck Company, also of Louisville. A few doors west is the Inter-Southern Building, the largest office building in the city, and the fact that there is heavy pedestrian traffic past the store shows the worth of the display windows. The company was organized about five years ago, with E. G. Burdorf, president; Charles P. Brecher, vice-president, and E. J. Hartmetz, secretary and treasurer. It has succeeded from the outset and caters to all classes of trade, doing a limited contracting business as well as a merchandising business.

The floors of the store are of interest to the lighting-fixture dealer. The building is 40 feet wide and some 200 feet in depth, with the usual high ceilings, the double-door entrance and rather spacious display windows on each side of the entrance. Under foot the whole first floor is tiled in attractive patterns and colors, and the woodwork is of fumed oak with furniture and fixtures to correspond. Classes of stock throughout the entire store are set off by themselves, either by means of built-in rooms, partitions, or hangings. This not only enables the salesman to handle the customer with the assurance of his attention not being distracted, but it permits grouping of the various grades of fixtures so that the costly kind does not suffer by reason of contrast with the cheaper fixture immediately beside it.

Entering the store the customer steps into a cozy reception room. It is 14 feet wide, with an open square-arched door leading on into the store, extends the full width of the store and is furnished with a table and chairs and a bench against the side wall. The elevator rises out of one corner. There is a good rug on the floor, to one side and under the table, but not placed so that all traffic into the store will wear it threadbare. The sense of coziness comes from a low ceiling, about 11 feet high. Originally this ceiling was about 18 feet, as in most of the older store buildings.

The height was reduced, however, by use of the partition across the store, which serves as the rest for one end of framing timbers to form the false ceiling. The framework was covered with composition board, which was papered. A high-grade paper was used and in color and design it harmonizes thoroughly with the tile of the floor, and tone of the woodwork and at the same time is the best kind of background for the wall brackets, portable floor lamps, hanging fixtures, etc., which are from time to time shown there, the decorations of this room being varied now and then. Here the customer is often met by the salesman, or waits for husband or wife by appointment. The atmosphere is pleasant and insures that the customer will get a favorable impression the moment he enters the store.

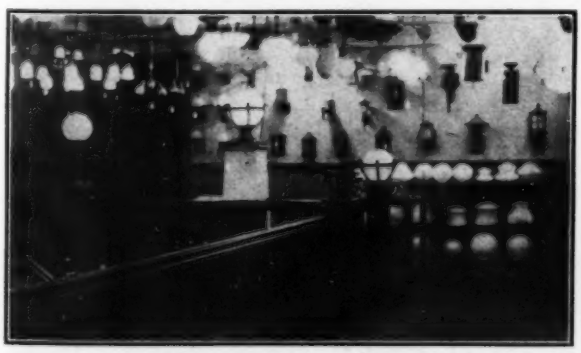
Through the open framed doorway, a wide one, the customer passes into a larger division which has the effect of a room, being defined at the further end by a partition

View in the Reception Room.

rising about eleven feet but not meeting in the center. On each side of the wide aisle are low rectangular platforms on which portable floor lamps are displayed, with shades of various patterns and materials, usually of mahogany standards, although there are painted and ornamental metal standards. On each side of this section stepped shelves of three steps have been built against the wall, covered with a green cloth. On these terraced shelves a large stock and variety of table lamps are displayed, including also the standards of various types of desk lamps, utilitarian but not ornamental. In one corner there is a line of similar standards which rise from the floor. The space overhead is occupied by types of the better class lighting fixtures for commercial buildings. They are of direct and indirect, semi-direct, shower, chandelier and other types, and are suspended from the full height ceiling, which shows them under conditions of actual use.

This completes the lamp display on the first floor. There is a division immediately behind that, which is given over to displays of the various types and kinds of fireplace fittings, accessories, etc., such as andirons, fire sets, wood boxes and racks, coal scuttles, hob grates, etc., many of them reproductions from famous originals. Behind this division on the left are the offices, set off by partitions solid up to the waist line and grilled above that. To the right is a built-in room given over entirely to samples of tile, and behind is the shipping, assembling and packing department.

The tone of the whole place is excellent. There is nothing garish about it. The service lighting is soft and well diffused and the colors are soft and restful, serving to set off the stock to the best advantage. Care and taste is used in placing of the items on display, so that there is enough contrast to emphasize the details of each article shown without clashing with its neighbor, to the detriment of both. One of the good things about this company is that it includes men who have keen artistic appreciations of color and form, and since the high-priced fixtures must depend largely for their sale on the appeal they make to the esthetics of the customers this is a valuable possession.



The Miscellaneous Display Room.

The customer who is met at the entrance of the store and who states his or her wants in a general way, likely, if lighting fixtures are wanted, will be taken immediately to the second floor by the elevator, which is an automatic affair. Stepping from the elevator, customer and salesman find themselves at the head of a corridor running back full length, apparently, of the store. Green hangings, pulled to the side like curtains in a home, with valances at the tops, divide this corridor into sections. Soft lights are burning in each so as to give a general view all along the passage. Unless, however, the customer has expressed a specific want, the salesman leads the way to the consulting room to the right, at the front of the building.

This is a room somewhat on the order of the reception room immediately below, though not quite as wide. It has a 11-foot ceiling—the rest of the floor is ceiled at 10

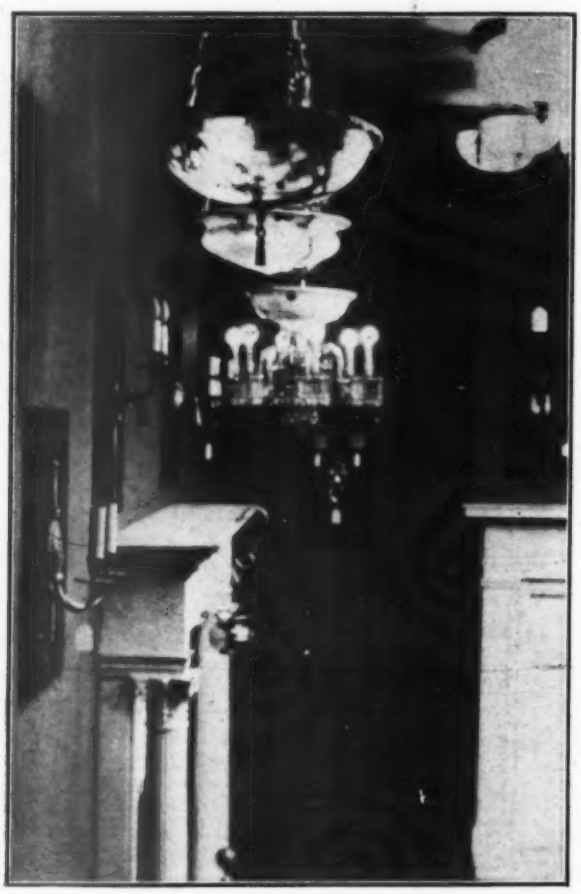
Looking Down the Corridor, Which is Divided by Curtains.

feet—all false, incidently, and provided for in the same manner as was that for the reception room on the first floor. Except that this consulting room has a remarkable wealth of lighting fixtures, it is treated almost as a room in a home. A good-sized table occupies the center, flanked by chairs, and supports an ornate table lamp. There is a good rug on the floor and the wall is papered with a high-grade paper. At one end of the room are filing cabinets where are kept the stock of illustrations of fixtures not in stock, or which are only made to order. This is a convenient and much-used room. The customer may sit in it while giving the salesman an idea of what she wants, or after a sale is made the room can be re-entered while directions are noted, "the papers signed," or for a summing up of what has been purchased and a statement of the costs.

There are in addition to this consulting room, itself a

display room, six other display rooms, all with 10-foot ceilings and about 12 feet square. Three mantels are shown in each room, incidentally giving that much more opportunity to display mantel lamps and over-mantel lighting fixtures. In the center of each room is a table, of good construction, material and form, and usually there is a table lamp or two. All these rooms have rugs; the floors are painted and harmonious in tone, and the walls get the same kind of treatment as to wall paper that the best homes have. There are no windows, and there is a multitude of "stalactite" lighting fixtures hanging from the ceilings. Otherwise the effect of displaying the fixtures in circumstances as if in actual use is always provided.

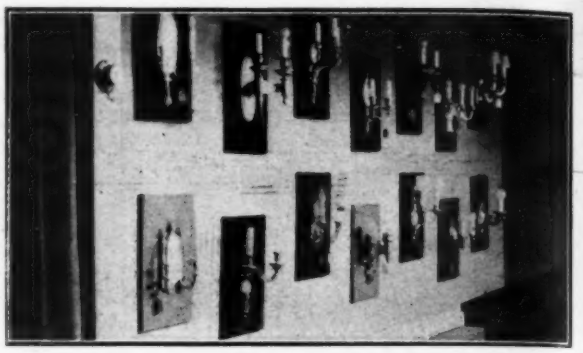
In addition to the seven rooms the corridor spoken of is divided by the curtains into five room-like divisions, which are handled in the same manner as the inclosed rooms. At the end of the corridor is a large open space where the



A View in One of the Display Rooms.

miscellaneous fixture stock is displayed. Here are the bracket lamps for residences or hotels; outside and inside lamps for newel posts, or for posts outside, finished in various styles, of iron, bronze, hammered brass, copper, etc. Slow-moving stock that is out of style, if it has not sold up front, is marked down and shown in this space. The cheaper fixtures for the humble home and a stock of globes are also displayed there. Beyond this section is the workroom.

In these various divisions the stock on display is grouped according to type of fixture and quality, material used, etc. This enables the display of silvered wall brackets and silvered mounted fixtures, for instance, together in a room with a dark paper, which, with the flood of light available brings out the charm of that metal or finish. One room will be given over to direct lighting fixtures of the same quality; another will have an assortment of indirect and



A Display of Bracket Fixtures Mounted on Boards Covered With Plush or Green Crepe Paper.

semi-indirect lamps for use in dining rooms; another may display an assortment of hall lamps of a good grade, showing a number of types. One hall division contains shower fixtures; another has chandeliers; candle fixtures grace one of the rooms; a small room near the back is fitted with fixtures suitable for bathrooms or kitchens, etc., etc.

Every lighting fixture put on display by the house is either connected at the time it is put up or can be attached to a convenient circuit merely by slipping a plug into place. Push buttons in the sides of the walls of the various rooms control the greater number of the lamps displayed in them, while others can be controlled by pulls. The system is to keep one small light burning in a fixture in each room, except the front consultation room which has outside light. In this way it is assured that a good idea of the stock shown can be gained without more light. And, in order to save energy—an important item in the course of a month—it is a rule that all lights except the permanent one are turned out when any room is vacated.

Scrupulous care is taken at all times to keep the stock itself and the display rooms, floors, etc., immaculately clean. All the packing and unpacking is done in a room at the rear and every item is carefully dusted and freed from packing material before it is brought into the store.

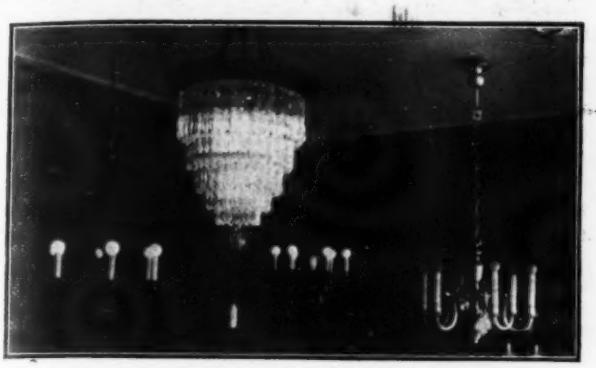
Another significant thing about this stock is the size of it. No matter what the customer is in search of there is always a good choice that can be made from the stock shown him. And if his wants happen to be extra special they can be supplied either to order from his designs, or from the illustrations of those which manufacturers are in position to make.

The Burdorf-Brecher Company installs all its own fixtures when purchased, thus insuring that the good effect of the acquisition of a desirable fixture is not destroyed or reduced by poor and incompetent installation. Only quality goods are handled and not a piece of plated stuff goes out of the store. The Burdorf-Brecher Company expects to continue in business for a long time and is proceeding with

The Method of Combining Fixture Displays With Mantels, Fireplace Accessories, Etc.

the intention of handling every customer on his first visit so that he will come back to this store again.

That is, in outline, the store of the Burdorf-Brecher Company. It was a more or less commonplace store at



Some of the Chandeliers Exhibited by the Burdorf-Brecher Company.

one time. But now, thanks to experience, taste, judgment and a sound merchandising policy, it has been given a distinction that is one of the biggest assets of such a store. Its wiring system conforms to the Code throughout and this was put in by the company's journeymen, while other artisans in the employ of the house made all the structural alterations, laid the tile floors and otherwise decorated the salesrooms as they have been described.

HOW THE LIGHTING-FIXTURE DEALER CAN MAKE THE MOST OF CATALOGS.

Listing "Supplementary" Stock in Cabinets, Using Manufacturers' Catalogs and Photographs.

Every retail dealer in lighting fixtures very properly considers that his stock on display is supplemented to the extent of the pieces shown in his manufacturers' and distributors' catalogs, their own supplementary illustrated sheets and the photographs which are coming to be a more and more important feature of the trade. No matter how large a stock a dealer may have he cannot hope to keep up with the manufacturers nor can he consider it practicable to stock one of every fixture on the market. But it is not always that he handles his accumulation of catalogs to insure that he can draw from the unlimited supply which is his when he wants it.

To get the most satisfactory use of this "supplementary" stock, it is not only desirable but necessary that the dealer be able to turn quickly to the illustration of what he wants to show a waiting customer. That means system. It means that the catalogs must not only be at hand, but that the salesman be able to indicate the choice available without holding a customer, who may not buy, and wasting his own time. An interesting and an elastic solution of how to handle this side of the business has been worked out by one dealer. He happens to have a large business and to be in touch with numerous manufacturers handling specialty work as well as stock work.

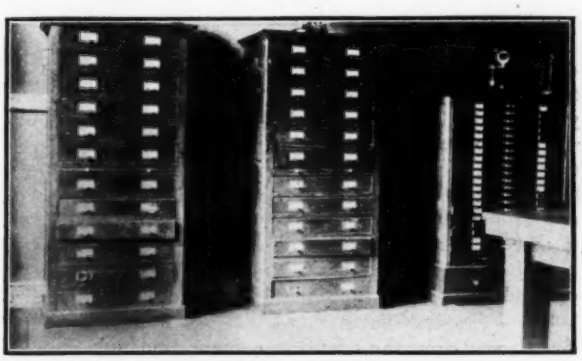
His pictures and descriptive matter are all kept in filing cabinets, where they are kept in careful order, with the contents of each drawer plainly indicated on a card on the outside of the front panel. Arrangement of the contents of these drawers is interesting. One, for instance, contains the cuts or photographs of wall brackets which can be ordered through the dealer and which are made on receipt of the order, none being carried in stock. Some are carved from wood, some are cast in moulds made for a special order and held for later chance use, or there are other conditions. Similarly there are drawers containing the same kind of data on other types of fixtures. One drawer contains illustrations of wall brackets which can be shipped, usually on receipt of order, but which the dealer is not stocked with; another contains data on the same kind of fixtures represented in the dealer's stock.

When it comes to the catalogs it is more difficult to work out this classification. But as far as possible the dealer does it. Instead of filing a catalog as a whole he breaks it up into its various divisions, sometimes fastening the pages by clips, sometimes cutting out each illustration with the accompanying data and pasting it on a mat. Where there is no mark that will identify the picture as from a certain maker's catalog, it is given a name or number. This method of breaking up a catalog sometimes makes it necessary to destroy the illustration on the other side. If it is a good one and the catalog has been made up in sections devoted to the various classifications the whole section is placed in the drawer.

Then if a customer, having gone through the stock, does not find the particular fixture wanted, he is taken to the cabinet room, placed at a table and the salesman gets out the group of illustrations of the kind wanted. Suppose it is a bracket lamp. The illustrations of available lamps are laid before the customer and he runs through them. The collection of those which may be ordered may then be laid before the customer. If it is not possible to find what he wants in that lot, where the file is complete as it ought to be, he does not know what he wants or else it will have to be a special order.

To be of value this plan of filing the catalog sections and the rest of the data must be kept up to date all the time. Having cut up his catalogs the dealer would be in trouble unless he had transferred them all to the file. Unless he was careful on this score, there would be difficulty when he wished to order stock. This mass of reference data ought to be kept every bit as live as the stock. When the dealer is notified that this or that model is not to be made any more, he should correct his file. If he sells a model represented by a card in the file, it should be taken out of the "in stock" section and transferred to the section containing data on fixtures which may be ordered.

Rightly kept and made use of, such a reference file is



Cabinets for Filing Manufacturers' Catalogs, Photographs and Descriptive Matter Pertaining to Fixtures Not Kept in Stock.

invaluable. It can be made as general or as detailed as the case of the individual dealer may require, but it must be kept up to date.

Last Northern Colorado Town Displaces Kerosene Lamps With Electricity.—The town of Wellington, Colo., recently held a celebration in honor of the fact that it is now lighted by electricity. The Western Light & Power Company installed the street lamps and wiring in the business houses, and is now wiring the residence district. The lighting of this town by electricity is notable because Wellington is the last town of northern Colorado to do away with a kerosene lighting system.

THE USE OF FIXTURE ROOMS FOR DISPLAYING EFFICIENT LIGHTING SYSTEMS.

Display Rooms That Aid the Central Electric Company's Campaign for Good Lighting.

The Central Electric Company, 320 South Fifth Avenue, Chicago, Ill., one of the largest manufacturers, importers and jobbers of electrical supplies in the Middle West, maintains three very attractive showrooms for the display of electric-lighting fixtures. It is the company's aim in maintaining these display rooms to have one for indirect, one for semi-indirect and one for miscellaneous lighting units. The display rooms are on the first floor and adjoin the company's main salesroom.

Display of Alexalite Indirect Lighting Units.

The first room is used for displaying Alexalite indirect lighting units and contains about 30 different designs. These fixtures are designed and furnished to harmonize with all styles and periods of interior decorations and architecture, and the purpose of the room in bringing out the excellence of this method of illumination is accomplished very well. A number of different styles of portable lamps are also exhibited in this room.

Adjoining the Alexalite room is one for the display of miscellaneous lighting units. Here is exhibited the company's line of Maxolite enameled-steel direct lighting fixtures. There are about 30 different styles of reflectors shown, which may be used to properly solve any lighting problem. There is also on display in this room types of window reflectors, flood-lighting units, and table, floor, piano and desk lamps.

The latter room connects with a room for the display of semi-indirect lighting units, including samples of Berylite and other miscellaneous lines of glassware. These globes are suspended from the ceiling and show their adaptability for the lighting of homes, offices, factories, etc., in a very effective manner.

For the past four years, the Central Electric Company has maintained a vigorous campaign for good lighting. Both the country and city sales forces are continually informed as to the best practice as put forth by the Illuminating Engineering Society and, with the co-operation of the illuminating department, take every opportunity to install an improved lighting system in an old building or secure contracts for adequate systems in new buildings.

Salesmen securing blue prints on the road from architects, engineers or owners, forward them to the illuminating department where plans are carefully gone over and engineering data sheets, together with recommendations, are submitted. In cases where propositions are of size or require specialized knowledge, an engineer from the illuminating department calls with the territory representative. The Central Electric Company is interested in and caters to all lighting prospects interested in good illumination.

The most successful results in office lighting have been obtained by the use of the Alexalite indirect system, because of the fact that working conditions are made most pleasant for employees, glare is prevented and desk lamps become unnecessary. In the Alexalite unit a reflector consisting of an enameled steel bowl 22 inches in diameter and 8 inches in depth is used. In order to secure the highest efficiency, the bowl is hung comparatively close to the ceiling. As a result of the liberal diameter of the bowl there is no cross-reflection and a very high efficiency is secured. This point, combined with the fact that it is suspended close to the ceiling, makes it possible to secure utilization efficiencies equal to those obtained from lighting units with corrugated mirrored glass reflectors. With the lighting efficiencies equal, the choice has been in favor of the porcelain enamel reflector because of its easy-cleaning and non-breakable qualities.

Among some of the more important systems of this type which the company has installed are the Chicago, Burlington & Quincy Railway Company's office building, Chicago, 2,100 units; Pullman Company offices, 500 units; Furniture Exhibition Building, Grand Rapids, Mich., 800 units, and Dodge Brothers Motor Car Company, Detroit, 800 units.

The Central Electric Company probably specializes more on the installation of lighting units than any jobber in the West. Its illuminating department has been given full sway as far as instructions as to what to sell are concerned, and gives the customer the lighting units that are best adapted for his service. The company manufactures some lines and job others, and is in a position to make an installation of any lighting fixtures on the market.

The activities along lighting lines cover not only offices, factories, homes, theaters, public buildings, etc., but they also extend to the railway-car and street-car lighting fields.

Much work and testing has been done on practical fixtures for use in railway cars, as a result of which Dalite system has been developed and is now in use on a number of dining and private cars. The Dalite system is similar in car lighting to the cornice lighting schemes used on buildings. Enameled steel troughs covered with glass are run the entire length of the car along the half deck, throwing the light to the ceiling and diffusing it to the room. The Pullman Company has recently standardized on single unit fixtures, using 100-watt type C lamps instead of the old four-light clusters. These fixtures are equipped with the Berylite glassware and photometrical tests indicate a large increase in efficiency.

Display Room for Berylite and Other Semi-Indirect Fixtures.

A Fixture Store Without a Display Window

Description of Showroom Appointments and Sales Plans of the Chicago Chandelier & Bronze Company, Which Is Located on the Third Floor of a Chicago Downtown Office Building

DEALERS who have a knowledge of modern merchandising methods fully realize the value of window space and attractive and original displays frequently changed. Trade papers are continually hammering on the utility of window displays to dealers in a well meaning effort to give suggestions for the better conduct of the electrical dealers' business, and indications seem to bear out the statement that dealers generally are using their window space to better advantage with satisfying results. Perhaps the best method of making a dealer realize the value of his window space would be to take it away from him. His appreciation would be keener, without a single doubt, and he would find it hard to make the best of conditions.

Contrast this dealer with one who never has had an opportunity of making a single window display and whose store is not on the ground floor. The average dealer, secure in his possession of a store front to attract passersby and main-floor store that makes the entrance of customers easy, will consider the keeping of a loft store under too much of a handicap to be successful. Yet these are the conditions under which the Chicago Chandelier & Bronze Company conducts its electric lighting fixture business—and a very profitable one it is. The company occupies five rooms—about 2,500 feet of floor space—on the third floor of the new Garland Building, Wabash Avenue and Washington Street, Chicago, Ill.

The company was organized about a year and a half ago by G. W. Kaiser, who is president; C. G. Ricklefs, vice-president; J. C. F. Ricklefs, treasurer, and F. J. Schuett, secretary and manager. The concern maintains offices, a main showroom and three smaller rooms, and has a factory for the assembly of its different lines of lighting fixtures. Practically its entire stock is purchased from the Beardslee Chandelier Manufacturing Company, of Chicago.

The most significant feature of the Chicago Chandelier & Bronze Company's showrooms is the appearance of roominess, together with carefully chosen appointments. On entering the store from the corridor, the customer is ushered into the main salesroom, a single room 45 by 19 feet with 12-foot ceiling. The appointments of this room, like those of the other showrooms, are simple and cozy, and there is no attempt made to have them highly dec-

A View in the Main Salesroom of the Chicago Chandelier & Bronze Company.

orative or ornate. The fixtures displayed are set off to good advantage and they themselves add distinctively to the appearance of the decorations. Polished floors and a good rug, two tables and a number of comfortable chairs, all of best quality, constitute the furnishings of the larger room. There are about 100 ceiling-type lighting units, comprising semi-indirect globes, shower and candle effects, exhibited in this room, together with about 50 wall brackets. The latter are mounted on removable plaques which are arranged on the walls. Two terraced display stands are used for showing a number of styles of fixture glassware.

Partitioned off from the main salesroom by walls that extend to within three feet of the ceiling are three showrooms, each about 15 by 18 feet. There are about 30 ceiling-type lighting fixtures and a like number of wall brackets displayed in each of these rooms. These fixtures are not grouped according to price, though companion pieces are placed near one another. While most of the fixtures are of the better grades, still there are a large number of cheaper quality shown—fixtures to suit almost any pocketbook.

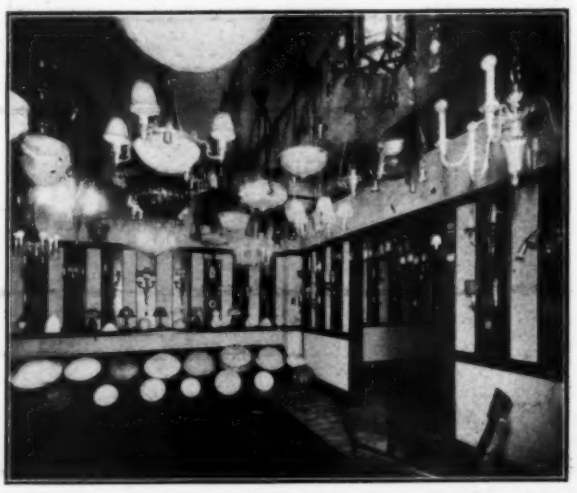
Adjoining the main salesroom and in a separate room are the offices and the designing department. Here designs are made for special fixtures to suit the varied tastes of customers or to harmonize with different periods or styles of decoration. The company is proud of its ability in this direction and secures considerable business by this service.

With the disadvantage of not possessing a show window, the sales plans of this company are interesting. One wonders just what appeal, or, rather, what special appeals, are made to the public in order to secure a full share of the lighting-fixture business. In this particular case, the entire business policy is founded on service to the customer. True, the concern employs a number of expert lighting-fixture salesmen, but, while they bring in many orders, the maintained reputation of the concern for service is the strength of the business. This service includes the help of experienced fixture men in selecting appropriate units for the customer's building, in guaranteeing that there will be no delay on the part of the dealer in making the installation, in supervising the ordering and installation of the fixtures, and many other services of similar nature. Compounding these efforts to please must necessarily result in satisfaction to the customer. This rendering of service does not involve complicated merchandising plans, but does insist on attention to details in the customer's interest. The latter and his architect and his contractor are thereby quickened to respond, when opportunities present themselves, by reciprocating for the service, and they do it in the best manner possible for the dealer—by recommendation. There is, perhaps, no better way in which to smooth the road to a sale than by the recommendation of a friend. A good word is worth quite a number of the salesman's sentences, and it is by this method many customers are induced to take the elevator to the third floor and purchase of the Chicago Chandelier & Bronze Company.

One of the Attractive Smaller Showrooms.

Besides the "loop" territory, the city of Chicago has been divided by the company into three other sales territories, each of which is given to two salesmen. Each salesman has an automobile, maintained at his own expense. Each morning the company receives reports of building permits issued the previous day and these are classified according to the sales territories and furnished as leads to the salesmen. In time the salesman becomes familiar with his territory and watches building operations so he will be in a position to make a bid for the sale of lighting fixtures. When he finds a prospect, an inspection will prove whether it is worth while to try and make a sale. If it is, he inquires for the name of the builder and his address. From then on it is pure salesmanship that may extend over a period of six weeks to four months. If he succeeds in getting the prospective customer to come to the store for an inspection of the company's fixtures he can usually close the sale.

When a sale has been made, the plans are carefully checked and the order made out in triplicate. One copy is retained by the sales manager who again checks it against the plans. Another copy is given to an experienced fixture



Two Companion Salesrooms, Both Notable for Their Roominess and Appointments.

man who inspects the building in which the installation is to be made, and who makes recommendations, if necessary, for changes in the order. Sometimes these changes involve a complete rearrangement of the wiring system in order to secure better lighting accommodations. When the order is finally deemed correct it is entered at the factory and the fixtures are made. After the installation has been completed the salesman makes a final inspection to see that the work is satisfactory. Terms are cash deposit with order and cash in 30 days after installation has been made.

Of course, the major part of the business done by the company is secured by the salesmen, though much comes unsolicited and forms a very stable income. Without being able to attract any business from the street, because of lack of show windows, a great deal of reliance is placed on the efforts of the salespeople, and it is to the company's interest to maintain a competent force, which at times is difficult because expert and energetic lighting-fixture salesmen, those with the ability to close an order and write it up, are not numerous.

Taking all things into consideration, the business is a very successful and sturdy one, and is a good example of what can be accomplished under what many dealers would consider a serious handicap.

THE ESTHETIC SIDE OF THE ELECTRIC LIGHTING FIXTURE BUSINESS.

Knowledge of "Periods" and Decorative Values Essential to the Dealer in Keeping Pace With Customers' Demands.

This is the day of the "period" in household decoration. Architects, decorators, designers of furniture, lighting fixtures, wall-paper and floor-covering patterns, window and door hangings, bookbindings, etc., out-Adam the Adam Brothers every other day, while the art principles of the early Jacobean masters, Chippendale or Sheraton are being wrought in articles of household plenishing those worthies never dreamed of. It is a very wonderful modern development, good for everybody who will take the trouble to post himself on periods and what they mean. It has sounded the death-knell of the hodge-podge and the abortions that in previous days were foisted on the undiscriminating public by over-ambitious manufacturers.

In other words the esthetic side is getting more attention in America than ever before. Line and form, proportion and color mean a good deal more to the average customer of the lighting-fixture dealer than they did to his father. He is getting art in the schools, the home magazines, absorbing it from the shop windows and the public buildings. Good taste grows by what it feeds on; not that all people buy understandingly, but they do buy with more or less feeling. They may buy a fixture today and take it home, thinking that they have what is appropriate and desirable. But unless it is the correct one, sooner or later they are going to reach that conclusion. They may not be able to tell what is the matter with it, but they will feel that something is wrong and that will influence them in a degree against the house from which they bought.

There are two practical angles on this proposition for the lighting-fixture dealer. In the first place, he should familiarize himself with "periods." It is not as difficult as might appear. Each period has its distinctive decorative motifs and more or less distinctive structural forms, which, once understood, will always be remembered. Any public library has books which will start the student on his exploration and many of the catalogs of the manufacturers are textbooks in themselves. Once started on this study the fixture man will find himself absorbed and fascinated. Then he will be better able to make the two practical applications of his knowledge that are suggested here.

One is that the period appeal is to those who, as a rule, are best able to indulge their desires in this direction. Either that, or the customer will be represented by a professional decorator, who, while keen for the best price possible, still wants good decorations. The well-posted fixture salesman can not only save time after he finds out the direction in which the customer's preferences run, but by sympathetic handling he will often be able to increase the bill of sale to an enthusiastic devotee of a particular period. Occasionally there will be poor people who make studies of art in household decorations, but for the most part this study is taken up by the well-to-do. When they come to "do over" their homes or to build new ones, they begin a study of architectural and period styles. Somebody in the family is pretty sure to become an enthusiast; then the dealer can push his highest priced fixtures of the same order with a good chance of making sales. Many of these period enthusiasts will most likely want conformity. In such a case the dealer who would try to interest a customer in an ornate Florentine wall bracket lamp, when that customer is building a severely classical Adam house, would not only waste his time, but might very possible lose the confidence of the customer.

Of course, a beautiful thing of one period may not go well with a beautiful thing of another period. Both of them are true to the laws of design. No dealer would think of suggesting a green iron wall bracket for a French drawing room, but to many a customer mixing the classic and the rococco is just as serious an error. This brings the second application to the front. To appeal to this discriminating trade by inciting its esthetic appreciations (and at the same time this does not diminish the appeal to those who are not educated) it is very desirable to observe the period proprieties in the displays.

An Illustration of the Method of Showing Fixtures and Furniture of Corresponding Styles and Periods.

Suppose, for instance, that the dealer was to set a delicately built, severely formed and daintily carved Adam table in his show window, with other incidental fittings in conformity. On top of that table he placed a gold and white table lamp, also modeled on severe Adam lines, and on the walls at convenient places he hung more Adam motifs in the Adam manner—an exquisitely distinctive, classical manner. The window would get attention. Nine men and women might pass and glance at it, and pass on thinking, "That's a pretty lamp." But the tenth passerby would pause and have an ecstatic fit right there on the sidewalk. That would be an *informed* window. It would do the very soul of the people with educated tastes good to see a window like that, and presently the store would have a reputation and a prestige that would be invaluable.

The retailer has to give the people what they want, or think they want, it is true, but that does not alter the fact that there is a big field for the man who will study the art side of the lighting-fixture business and then apply it for the benefit and the edification of the high class trade, which has the money to pay for what it wants and which, more often than may be thought, knows exactly what it does want.

NEW APPLIANCES

A Weekly Review of the Latest Developments and Current Information Respecting Electrical and Kindred Mechanical Appliances

Developments in Maxolite Steel Reflectors.

The Central Electric Company, 326 South Fifth Avenue, Chicago, has announced a number of additions to its line of enameled-steel Maxolite reflectors. The Maxolite is a one-piece porcelain-emaneled-steel reflector for industrial lighting, and is made in the flat-cone, shallow-bowl, deep-bowl and angle types.

One of the popular units in this line is the so-called

"Big Blue" Shallow-Bowl Maxolite Reflector.

"Big Blue" Maxolite, which is of the shallow-bowl type and is made for type C Mazda lamps in sizes from 300 to 1,000 watts. This unit is 18 inches in diameter and 12 inches deep and drawn from one piece of steel, there being twenty operations in its forming process.

The flat-cone type Maxolites are designed so as to bring the filament of type C lamps directly in line with the lower edge of the reflector, thus distributing all the light below the horizontal.

The shallow-bowl or skirted-cone types have a cutoff angle of 15 degrees below the horizontal, screening the filament from the eye, but at the same time the shape of the reflector produces a uniform distribution of light.

The deep-bowl units have a cutoff angle of 25 degrees, which is considered as the critical angle for avoiding glare. It is therefore an excellent unit for industrial work where units may be spaced closely.

All of the new Maxolites are characterized by an exterior finish of rich dark blue and a pure white diffusing surface inside.

As complete lighting units, Maxolites are furnished with a type R fitting, which is tapped for one-half-inch conduit and an easy-to-wire, thoroughly weatherproof socket, which is equipped with a lamp grip. The type R fitting has a cork washer in the reflector and a lead washer above it, so that it is impossible for the enamel to be attacked by moisture or acid.

Deep-Bowl and Angle-Type Maxolites.

Another important development in fixtures equipped with Maxolites is the new patented flexible suspension, known as the "always vertical suspension." This outfit consists of a liberal-sized cast-iron canopy with screw holes to fit a standard four-inch outlet box. It therefore allows ample room for making all connections. It has a ball joint, the lower end of which is tapped for one-half-inch conduit. This ball joint permits the fixture to swing through an angle of 25 degrees in any direction, should it be struck by a moving object; yet it is so arranged that it can not turn in a horizontal plane and thus twist off the fixture wires.

It frequently happens in factory buildings (especially

New "Always Vertical" Suspension for Maxolites.

those of concrete construction) that the outlet box is not set in perfectly straight and it is difficult to make fixtures suspended from it hang perpendicular. With this new suspension the stem of the fixture will always hang vertical, thus improving the appearance of the installation and bringing the lighting units and lamps into their most efficient position.

The use of this patented fitting makes a stud, crow foot, hook and box cover unnecessary. The market price of the fitting is so little in excess of the parts that it replaces, that it readily pays for itself in the saving of labor in installing.

The "always-vertical suspension" has been thoroughly tested and is approved by the National Board of Fire Underwriters.

Attachment for Electrifying the Old Oil Lamp.

Before electric table lamps became very popular, oil lamps had been much in use and many of these, being quite ornamental, are still retained in old families, although seldom used as illuminants. To restore these to modern ideas of usefulness, an improved oil-lamp attachment has been placed on the market which in a few moments electrifies

Hubbell Oil-Lamp Attachment.

the lamp. It can be applied to any lamp having a common flat-wick or cylindrical-wick burner. The old lamp chimney is removed and in its stead the new electric adapter is sprung in place, being held by the fingers that usually hold the chimney. Current is supplied by the attached cord from any convenient socket or wall receptacle. The device includes a standard Edison base receptacle for a lamp, seven feet of connecting cord and a new-style porcelain separable attachment plug. This complete adapter is manufactured by Harvey Hubbell, Incorporated, Bridgeport, Conn., and is an improved form of the similar Hubbell device formerly on the market.

Ostrander Battery Cabinets.

When wiring for bells, buzzers, annunciators, fire alarms, etc., for which dry batteries are to supply the current, it has been found desirable to provide a well constructed cabinet for housing the battery. The electrical contractor that usually consumes considerable time in building such cabinets out of wood should be interested in a substantial and very convenient cabinet that is being made by W. B. Ostrander & Company, 371 Broadway, New York City. These cabinets, as shown in the accompanying illustration, come completely wired and it is necessary merely to attach the terminals of the circuit. For this reason they are called "wireless" battery cabinets. The standard cabinets are made of No. 16 gauge steel finished in hard enamel. The door is hinged and has a solid brass padlock with duplicate keys. The suport for the cells is a strip of hard wood thoroughly saturated with an insulating compound. The bottom of the cabinet is ventilated and is entirely isolated from the cells.

As can be seen in the illustration, the connections between the cells are made by means of connector strips which are mounted on an insulating board secured near the top of the cabinet. These connectors are made of phosphor bronze, which is spring tempered so that the connectors bear down on the cell terminals with considerable pressure, thus insuring a positive contact and eliminating the liability to become loosened. The cells are very quickly installed and replaced when worn out, all this being done without any of the ordinary connecting wires. Knockouts are provided near the upper edges of the sides for bringing in conduit or bushings for the circuit wires.

Ostrander Battery Cabinet.

These cabinets are made for receiving any standard round dry cell 2.5 inches in diameter and 6 inches high. The cabinets are made for receiving 4, 6, 8 or more cells. Special cabinets are also made for square cells or other forms of primary batteries.

Benjamin Safety Screw-Base Flush Receptacles.

A screw-base receptacle is the only type which will accommodate all makes and styles of attachment plugs. The principal objection to such a receptacle, as commonly known, is the possibility of shock by accidental contact or the short-circuiting of contacts, and excessive arcing with the danger of short-circuits on removing the plug with the circuit closed. The new Benjamin safety receptacle removes these objectionable points.

Both contacts are normally dead and become alive only upon screwing the plug home. The center contact has to be pressed solidly inward. The outer or shell contact becomes alive only when drawn outward. In removing a plug with the current on, the circuit is broken at three points in series, thus greatly reducing the possibility of serious arcing.

Safety Flush Receptacle, Rectangular Type.

Round Receptacle With Rectangular Plate.

Round Flush Receptacle With Round Plate.

Two forms are supplied: (1) an elongated receptacle for use in rectangular flush boxes; (2) a round receptacle with concealed binding terminals that will pass through an opening 1.75 inches in diameter. This round receptacle can be furnished with round brass plate 3.625 inches in diameter or with the usual rectangular plate.

The devices are easily wired. The elongated receptacle is provided with wire grooves extending across the face to facilitate gang wiring. Buildings equipped with them will receive any standard plugs for portable devices whether solid, swivel or separable. These receptacles are made by the Benjamin Electric Manufacturing Company, 120-128 South Sangamon Street, Chicago, Ill.

Small Electric Flatiron for Light Work.

In laundering small pieces, such as handkerchiefs, laces, baby clothes, etc., it has been felt that a small and lightweight electric flatiron would prove more convenient and suitable than the ordinary six-pound household iron. For this purpose, the International Electric Company, Indianapolis, Ind., has developed and placed on the market a special one-pound iron known as the "International Baby."

Light-Weight or "Baby" Flatiron.

This is a well constructed iron and has a heating element consuming only 90 watts. It is extremely simple in design and substantially foolproof since it has no small parts to get out of order. The heating element is thoroughly imbedded in cement so as to make it practically impossible to burn it out.

On account of its light weight and compactness this "Baby" iron is advantageous to travelers who find it easy to pack in a suitcase and very convenient when it is desired to press handkerchiefs, lingerie, laces, linen cuffs and collars, waists, etc.

It is in frequent and handy pressing of baby clothes and in other fine work, however, such as plaits, sleeves, ruffles, etc., that this iron finds its greatest household use. Its current rating is ample for the light work for which it is designed and the resultant low energy consumption appeals to the economical housewife. In spite of its excellent construction this iron is sold at an exceptionally low price.

Electric Water-Heater for Soda Fountains.

In anticipation of cool weather, soda fountains and soft-drink establishments must make preparations for supplying hot drinks conveniently and in a sanitary manner. For this purpose the electric water-heater, which is entirely self-contained and made up as an ornamental device for use on the counter, has been found especially suitable for the quick and convenient preparing of chocolate, cocoa and other hot drinks.

The National Stamping & Electric Works, 410 South Clinton Street, Chicago, Ill., has ready for the market a considerable number of types of electric water-heaters especially suited for this purpose. The one illustrated herewith is one of the less expensive types, which like the others is entirely self-contained. It has a capacity of three quarts. The metal part of the device has a fine nickel finish, making it a very attractive addition to the soda-fountain equipment. The switch is conveniently placed in the base of the outfit. The standard equipment has an opal-glass globe, but a cut-glass globe can be supplied if desired.

Electric Water-Heater.

Various other designs are made by the company, both with and without glass globes. These range in capacity up to as high as four gallons. Some of the outfits are provided with two-heat switches. All of them are arranged so as to deliver hot water very rapidly after the switch has been turned on. They will operate on standard-voltage circuits and the heating unit is so proportioned that it may be connected to any lighting outlet without danger of blowing a fuse. They are economical as well as convenient in operation.

Wiremold and Fittings.

Wiremold, a new product being manufactured by the American Conduit Manufacturing Company, Pittsburgh, Pa., has been designed to meet the demand for a surface wiring material, which would be comparatively inexpensive, of small size, easy to install and which would require few fittings. As will be seen from the accompanying illustrations it is very neat and compact, being just large enough for the easy fishing of a pair of No. 14 or No. 12 wires.

According to the manufacturers, the assembly and installation of Wiremold calls for no special tools, slots,

Figs. 1 and 2.—Wiremold and Coupling.

holes or screws as it is simply cut into the length required and placed over the coupling tongues of the fittings.

The fittings supplied with this material are few in number, of simple design and arranged wherever possible for use with standard fittings and material. Wiremold is finished with a neutral-toned enamel which blends with the color of the average wall upon which it is used. It is furnished complete with one coupling to each length, goes up in one piece and in many other ways works so much like conduit that no especial experience is needed to install

Figs. 3, 4 and 5.—Steps in Coupling Wiremold.

it. It is made in two sizes only, twenty-one-thirty-seconds inch wide and fifteen-thirty-seconds inch thick overall and is furnished in 10-foot lengths, designed for surface wiring exclusively. Wiremold base and capping is permanently assembled at the factory, hence conductors cannot be layed into it as in similar materials, but must be fished in all cases.

Fig. 1 shows a section of Wiremold, which, like rigid conduit, is furnished with one coupling to each length, as shown in Fig. 2. To install, it is only necessary to push

Figs. 6 and 7.—Coupling for Connecting to Wood Molding or Open Work and Plan of Latter Connection.

the coupling forward until the screw hole is clear and then fasten to the wall with No. 8 flat-head wood screws as shown in Fig. 3. The next length must then be slipped over the edges of the coupling as shown in Fig. 4 and closed up as shown in Fig. 5.

One of the fittings is shown in Fig. 6, which is an open-work and wood-molding coupling. This is a two-piece porcelain casting with metal base plate and is finished to match Wiremold. It may be used as a coupling between Wiremold and open work as shown in Fig. 7 or as a

Figs. 8 and 9.—Plain Tee and Cross Fittings.

coupling between Wiremold and the dead end of a run of wood molding. It may also be used in conjunction with porcelain wood molding tees of any standard design, to tap from the side of an existing run of wood molding.

Two other fittings are shown in Figs. 8 and 9, Fig. 8 being a plain tee and Fig. 9 a plain cross.

Window Trim to Promote Sale of Suction Cleaners.

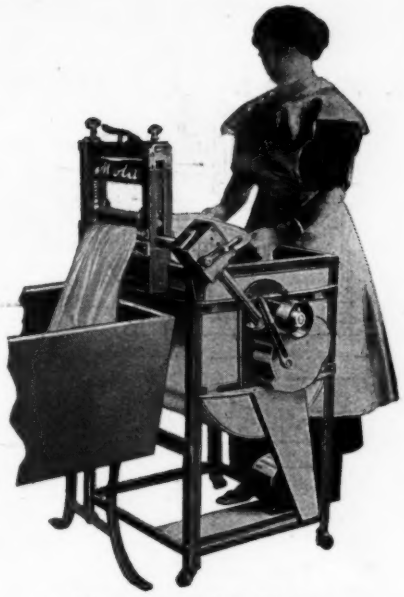
In order that dealers may arrange effective window trims of Apex electric suction cleaners with very little effort and in comparatively small space, the Apex Electrical Manufacturing Company, 1111 Power Avenue, Cleveland, O., is furnishing dealers with photographs of various simple trims (one of which is shown above) together with all the cards necessary to complete it. These cards are all made by an expert card writer and have the desirable hand-made finish about them that makes them stand out so much better than the common printed kind. The various selling points of the machine are cleverly shown by arranging machines minus the bag and handle in such positions as to permit the cards to point out the special features.

Window-Trim Suggestion to Promote Cleaner Sales.

The Apex cleaner is driven by a universal series motor that will run equally well on direct-current or alternating-current circuits. The nozzle of the cleaner is of special design to maintain uniform suction power across its entire 13-inch opening. The air and dust is drawn in along straight lines and at constant velocity throughout the machine, thus eliminating any tendency to deposit dirt along or befoul the passages. There are three adjustable nozzle positions to suit the nature of the cleaning being done. An automatic and simple oiling system provides lubrication. Various attachments are included with the Apex cleaner for cleaning mattresses, upholstery, drapery, etc.

New All-Metal-Type Electric Washing Machine.

The latest-type "Mola" electric washing machine is herewith illustrated. It is a modification of the type described in our issue of February 26, 1916. This new machine is of the reversing-cylinder type and is of all-metal construction. The cylinder automatically reverses every fourth revolution



New Mola Electric Washer.

and is made of heavy galvanized steel or heavy sheet copper, tinned on both sides.

All gearing is on the side of the machine and runs in grease-tight housings, which makes a noiseless and durable machine. The main gear is a cut-steel wormgear with a speed of less than 500 revolutions per minute. Only two levers are used to operate the machine, one to stop, start or reverse the wringer, and the other to start or stop the cylinder.

The new Mola machine is made in the regular family size with a capacity of 6 to 8 sheets. One of the special features of this machine is the gas heater which heats the water right where it is used. Machines are also furnished without this heater, however. The washer takes up only a small floor space of about 25 by 30 inches and can be moved about easily and will go through any door. It is equipped with a one-quarter horsepower special splashproof washing-machine motor.

This washing machine is manufactured by the Modern Laundry Machine Company, 1907 Central Street, Kansas City, Mo.

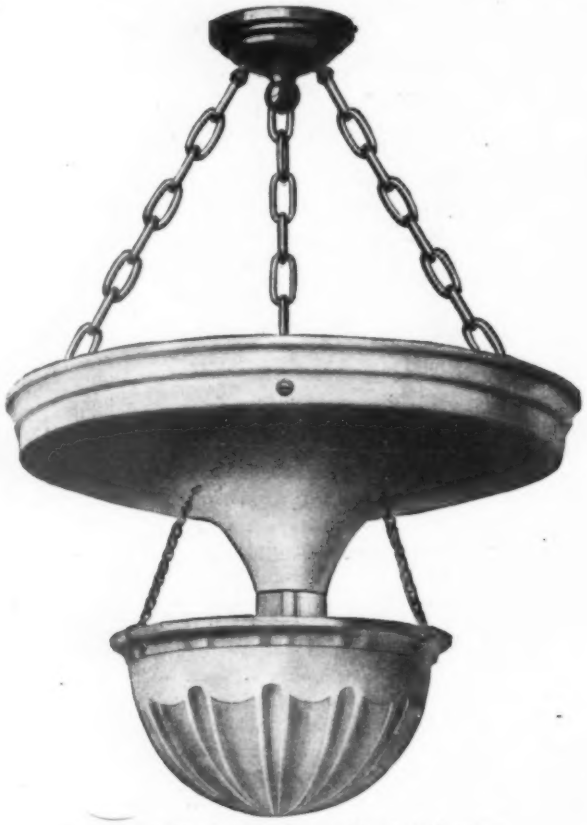
New Screwless Globe and Shade Holder.

With the increasing size and weight of illuminating glassware there is more and more need for supporting it safely and securely, both to prevent the liability of injury from falling heavy glassware and to avoid the loss due to breakage. An ingenious patented form of holder to accomplish this has been placed on the market by H. G. McFaddin & Company, 38 Warren Street, New York City, that solves the problem satisfactorily. This new type of holder supports the glassware entirely from the inside and without strain of any kind. It can be quickly installed and the globe, ball, shade or reflector readily put on or removed. It is made of brass and is free from screws or threads. The illustration shows how it is used. The outer part of the holder is raised until the inside flange or ring swings freely. This can then be tilted to one side and slipped into the globe opening.

Partial Section of Mefco Screwless Globe Holder.

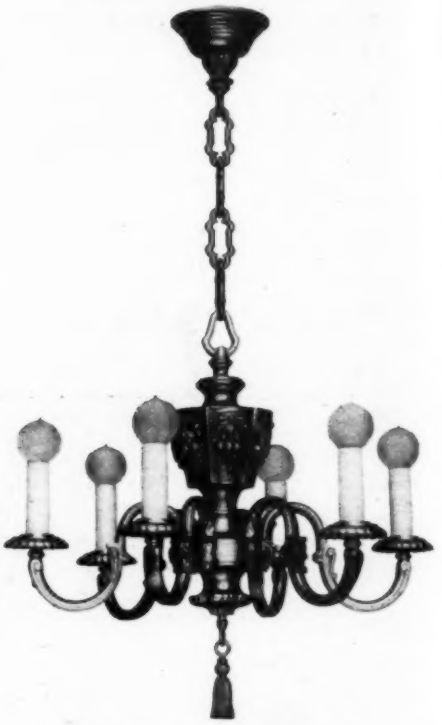
Newest Types of Lighting Fixtures

Illustrations and Brief Descriptions of Representative New Fixture Types and Designs Being Put Forth by the Leading Fixture Manufacturers

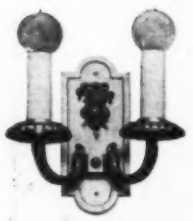


Amco Reflectolight fixture with chain hanger. An inexpensive type of semi-direct fixture designed for use with gas-filled tungsten lamps. The curved reflecting surface has a special, baked, durable, white enamel and is shaped so as to reflect the light outward and downward. The Art Metal Manufacturing Company, Cleveland, O.

Amco Reflectolight without hanger. Similar to above, but intended for mounting directly on ceiling. Glass bowl is of special Alba white glass and hung by patented globe-holding clips. The Art Metal Manufacturing Company, Cleveland, O.



Beardslee candelabra. Especially suitable for dining room. The arms and ornamental parts are of cast brass, arms being cast in one piece and bored out for the wires. No tubing is used. Plainer parts are spun. Furnished with imitation candles, often covered with silk shades. Finish usually antique silver. Beardslee Chandelier Manufacturing Company, Chicago, Ill.



Beardslee candle bracket. Companion to candle fixture shown above, and like it a good example of high-grade chandelier work.

Beardslee semi-direct fixture. Of popular type for reception halls, sun parlors and bed rooms. All metal parts are of cast brass, including canopy, ornamental harp, pendant, bottom rosette and tassel. Bowl is 14-inch Calcite glass and contains two 40-watt lamps entirely concealed. Beardslee Chandelier Manufacturing Company, Chicago, Hl.

Living-room fixture with cast brass arms and etched glass shades. A Greek type of design that is an ornament in any modern home. Brassart Fixture Company, New York City.

Candelabra fixture of Adam period specially designed for dining rooms. The large silk shade 22 inches in diameter gives a pleasing and unique effect that is finding decided favor. Brassart Fixture Company, New York City.

Reed ceiling fixture of semi-indirect type. Bowl is 21 inches in diameter and lined with cretonne of floral design. Reed links of chain are hand made and entire unit has a harmonious finish. Specially popular for sun parlors and summer homes. Chicago Reedware Manufacturing Company, Chicago, Ill.

Spun pendent fixture of simple design. Has socket shells of unusual length to fit close on frosted lamp bulbs. Can be made with various numbers of arms. The Brass Fixtures Company, Southington, Conn.

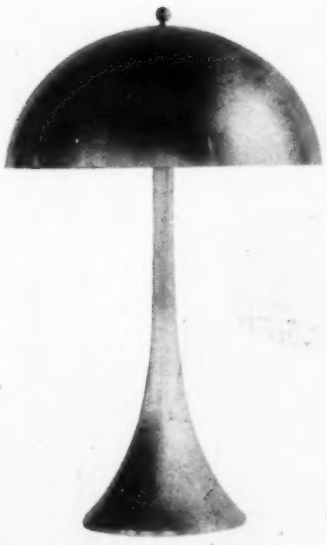


Table lamp of unusual type. Made entirely of brass spinnings. Marked by extreme simplicity and exceptionally graceful and artistic lines. Particularly suitable for desk or table use where all the light is to be thrown down. The Brass Fixtures Company, Southington, Conn.

Reed table lamp. Shade is 18 inches in diameter and lined with silk or other pleasing material. Usually provided with two pull sockets. Can be given various finishes to harmonize with room or veranda decorations. Chicago Reedware Manufacturing Company, Chicago, Ill.

Reed floor lamp. Full height 65 inches; shade 23 inches in diameter. Can be lined and finished same way as table lamps. A popular lamp for reading and needlework. Light in weight and easy to place where desired. Chicago Reedware Manufacturing Company, Chicago, Ill.

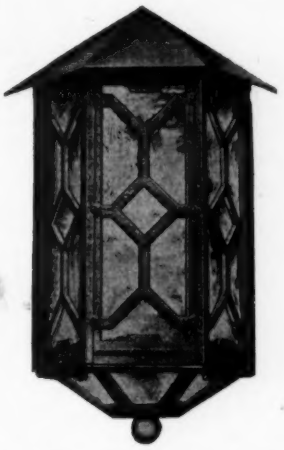
Side bracket for living rooms and libraries. Candelabra effect to harmonize with fixture shown below. High-class fixture of moderate price. Robert Findlay Manufacturing Company, New York City.

Four-light candelabra for living room or library. Matches bracket above. Length 36 inches, spread 16 inches. Made in Etruscan bronze and finished in gold, old brass and black, or silver. Robert Findlay Manufacturing Company, New York City.

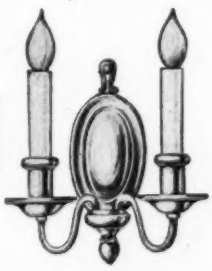
Findlay one-light pendant of attractive design. Length 36 inches, diameter 10 inches. Made of Etruscan bronze, a special alloy made by Robert Findlay Manufacturing Company, New York City.

Handel semi-indirect fixture for dining room or living room. With 16 or 18-inch glass bowl. Hanger arms specially designed to get away from common chain suspensions. Pleasingly finished. The Handel Company, Meriden, Conn.

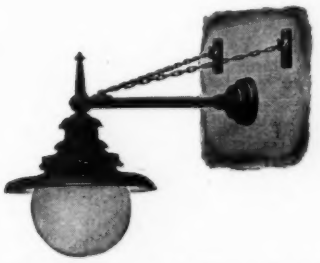
Ornamental outdoor entrance standard, 4 feet high to center of ball. Shaft is covered with two-inch strap iron to add to appearance and strengthen fixture. Herwig Art Shade & Lamp Company, Chicago, Ill.



Entrance lantern. Made entirely of cast metal; 18 inches high, 10 inches wide and 4½ inches deep. Art-glass panels. A type of fixture of increasing popularity. Herwig Art Shade & Lamp Company.



Simple colonial candle bracket for living room or dining room. The Handel Company.



Outdoor bracket for theaters and store fronts. Ventilite triple-ventilated holder specially suitable for gas-filled tungsten lamps of 100 to 1,000 watts. Very durably made for withstanding the most severe climates. Herwig Art Shade & Lamp Company, Chicago.

Lantern of old ship type. For use at entrance doors, porches, etc. The Handel Company, Meriden, Conn.

Handel one-light pendant specially suitable for reception halls or dens. Finished in very attractive manner. The Handel Company, Meriden, Conn.

Harter Deluxite. Canopy reflector 27 inches in diameter and finished with dull white surface for properly reflecting the light downward and outward. Direct light is well diffused by glass bowl. Also made for chain suspension. Harter Manufacturing Company, Chicago, Ill.

Table lamp with ornamental glass shade. One of an extensive line of portables, comprising designs of the most popular shapes and materials. Lamb Brothers & Greene, Nappanee, Ind.

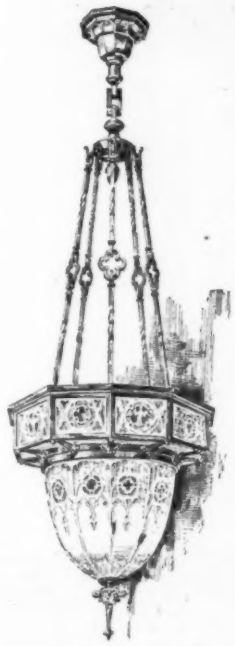
Rozelle decorations in color applied to four types of Veluria glass bowls and shades. This color is fired and therefore permanent. These decorations, on account of their artistic designs and harmonious colors, compare with the color treatment of the best porcelain and china, until now not successfully duplicated in glass. Satisfy the present-day love of color for home decorations. Ivanhoe-Regent Works of General Electric Company, Cleveland, O.

Brascolite ornamental diffusing fixture for residence use. Built on the same principle as the standard Brascolite, but provided with ornamental reflector and decorated bowl. Made with 16 and 19-inch reflectors and suitable for type C Mazda lamps from 100 to 300 watts, thus making an efficient ceiling-mounted unit giving wide distribution of light. Luminous Unit Company, St. Louis, Mo.

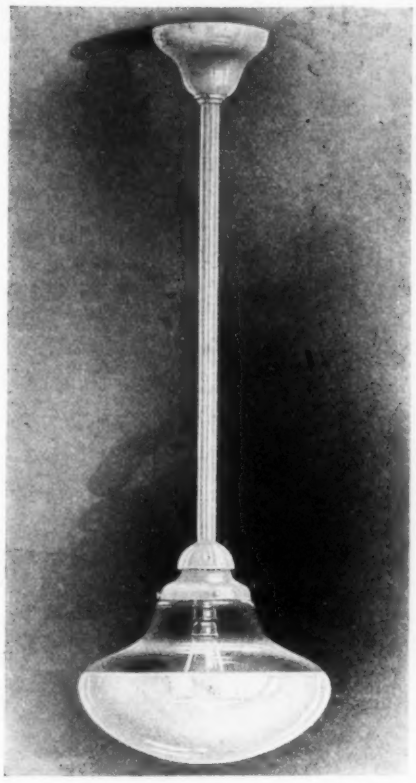
Floor lamp with solid mahogany standard and base and silk shade. Typical design made by Lamb Brothers & Greene, Nappanee, Ind.

Ornamental bracket with semi-indirect glass bowl. A beautiful unit for places where designs with substantial lines are needed. Macbeth-Evans Glass Company, Pittsburgh, Pa.

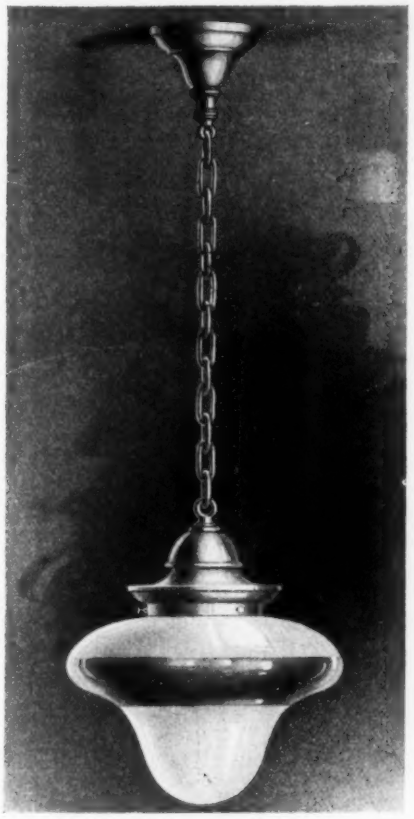
Beautiful and unique type of luminous-urn fixture especially suitable for stairway pedestals in hotel and club lobbies. Macbeth-Evans Glass Company, Pittsburgh, Pa.



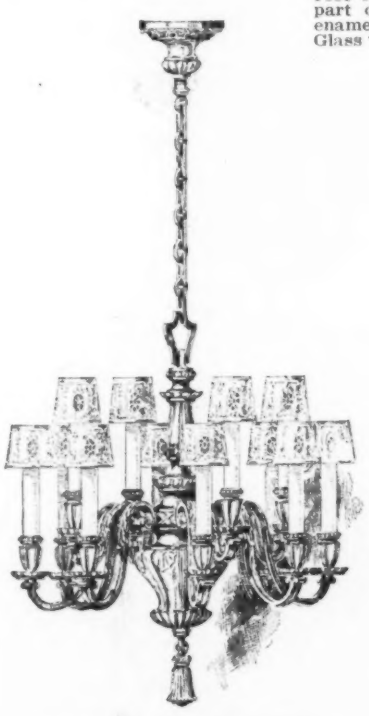
Ornamental pendent fixture especially suitable for churches where fine decorative treatment is necessary. The glassware is beautifully decorated in two colors. Macbeth-Evans Glass Company, Pittsburgh, Pa.



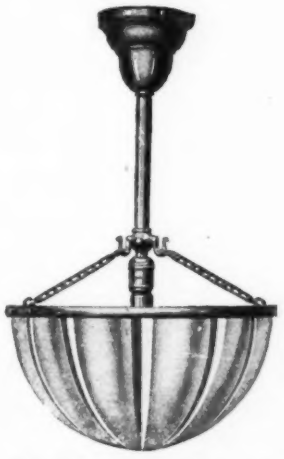
Ajaxolite semi-direct fixture for hospitals. Glass globe entirely incloses lamp; lower part of globe is white enamel; diffuses direct light and reflects through clear upper part of glass. Simple and sanitary white-enamel unit, easy to clean. Macbeth-Evans Glass Company



Ajaxolite semi-direct fixture for commercial lighting. Corresponds in principle to hospital fixture shown at left, but glass globe has white enamel reflecting top. Metal parts have brush brass finish. Like all Ajaxolites, fixture is well ventilated. Macbeth-Evans Glass Company, Pittsburgh, Pa.

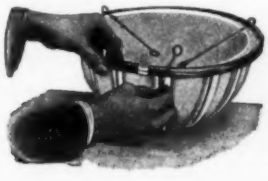


Beautiful candelabra fixture particularly appropriate for dining rooms. Like the other Macbeth-Evans ornamental fixtures shown, this has the metal parts finely finished and the glassware attractively decorated in colors. Macbeth-Evans Glass Company, Pittsburgh, Pa.



Mefcolite semi-direct unit with Nubolux glass bowl for commercial lighting. Bowl-supporting rods easily adjustable to suit any size of lamp. Also made more ornamental. H. G. McFaddin & Company, New York City.

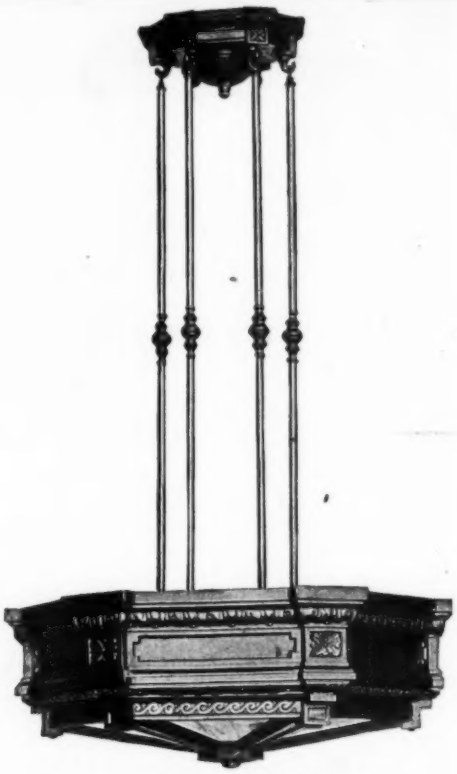
Mefcolite unit with one bowl support unhooked to let bowl swing down for ready cleaning or removal of lamp. Bowl is clamped by continuous ring at upper edge and cannot drop out.



Mefcolite unit. By unhooking one support at joint in bowl-clamping ring, the bowl is easily removed. H. G. McFaddin & Company.

Three-candle bracket. This attractive fixture is executed in Armor Bronze, a seamless electrical deposit of bronze over a reinforced fibrous composition core. The National Metalizing Company, New York City.

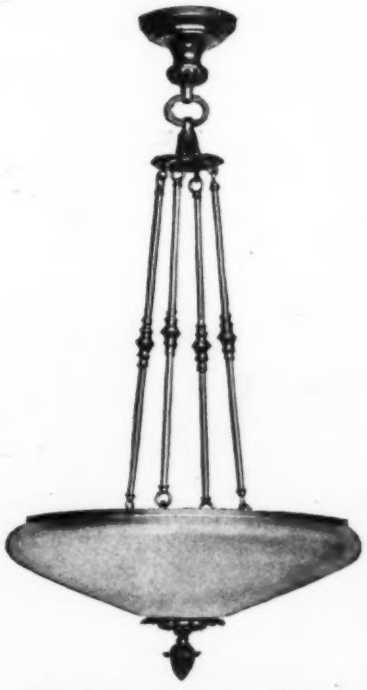
Single-lamp ceiling pendant. Beautiful design in Armor Bronze. Full length of fixture, including glass, 48 inches. The National Metalizing Company, New York City.



Indirect fixture of composition. For large interiors with high ceilings, such as banks, auditoriums, etc. May contain as high as four 200-watt type C lamps, each with mirror reflector. Practically shadowless suspension. National X-Ray Reflector Company, Chicago, Ill.

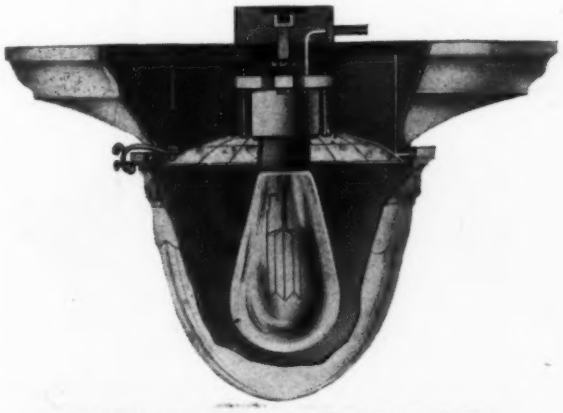
Large Doric pendant specially ventilated for use of gas-filled tungsten lamps. Cold air enters through globe and leaves through concealed exits, protected from dust and dirt. New York Gas & Electric Appliance Company, New York City.

Indirect unit with luminous bowl. Contains silvered-glass reflector with opal-glass diffuser in bottom, latter permitting small amount of light to illuminate the inclosing glass bowl. National X-Ray Reflector Company, Chicago, Ill.



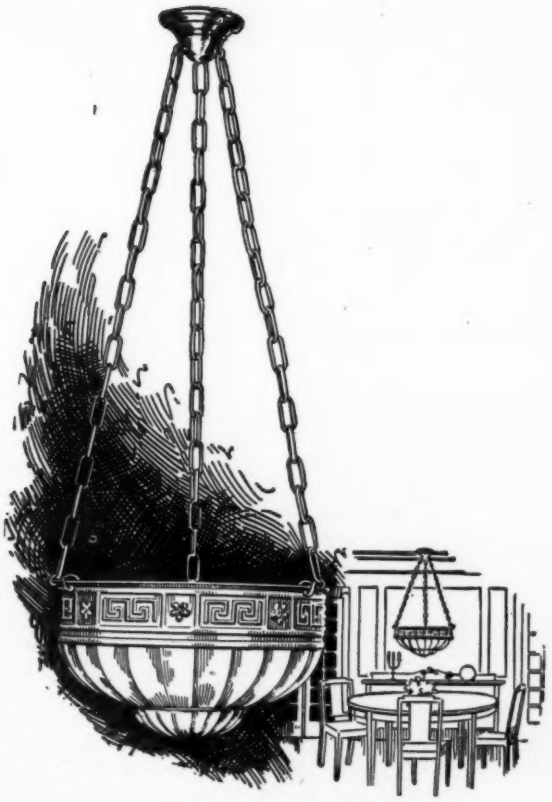
Indirect fixture of brass. May contain 2, 3 or 4 100-watt type C lamps, each with mirrored-glass reflector. Especially suited for private offices about 12 feet high. One fixture suffices for room 20 feet square. National X-Ray Reflector Company, Chicago, Ill.

Perfeclite chain-suspended fixture. Designed for lighting of public halls, lobbies, etc. Also made in simpler designs. The Perfeclite Company, Seattle, Wash.



Interior construction of ceiling-mounted Perfeclite unit. Above base of the lamp is a silvered reflector which eliminates waste of light in interior of fixture. Unit is well ventilated for use of gas-filled lamps and is easily wired. The Perfeclite Company.

Perfeclite ceiling-mounted unit of simple design. Especially suited for efficient store lighting, office lighting, etc. Top spinning 16 inches in diameter. Bowl is of Monax highly diffusing glass. Also furnished for chain suspension. The Perfeclite Company, Seattle, Wash.



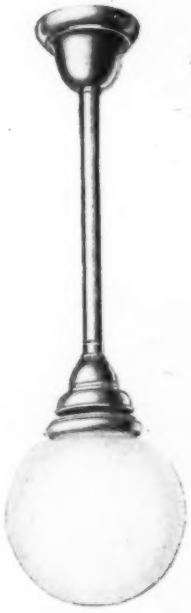
Exemplar special semi-direct fixture. A well built but inexpensive simple fixture produced to sell at an astonishingly low price. Made with 14 and 16-inch bowls. Small view at side shows appropriateness of this fixture for dining rooms. Specially useful in low-cost house-wiring campaigns. Pettingill-Andrews Company, Boston, Mass.

Reflectolyte Junior. New and inexpensive type of Reflectolyte unit. Made with reflector dome of depolished white opal glass. This allows some light to pass through to the ceiling, but reflects most of it down. The reflector and bowl are each supported without screws and easily removed for cleaning. The Reflectolyte Company, St. Louis, Mo.

Design for candle side bracket for a room decorated in the Adam period, being an adaptation of that style to modern requirements. A typical fixture produced by a firm of designers who put individuality and the highest art into each of their products. Tiffany Studios, New York City.

Reflectolyte Junior of the most simple type. Especially designed for lighting of stores, etc., where low cost is important. Like the fixture above, this unit has an adjustable feature making possible the use of either 75, 100 or 200-watt lamps. The Reflectolyte Company, St. Louis, Mo.

Ohmlite pendent unit. The distinctive feature of this unit is the special glass globe, which is provided with ribs, either straight or curved, which act like prisms in giving a certain dispersion of the light and reflecting it downwardly, upwardly or laterally, as desired. The glass also thoroughly diffuses the light to minimize glare. On account of spectral control, this unit is claimed to be especially adaptable for color matching. Moran & Hastings Manufacturing Company, Chicago, Ill.



Substantial tube pendant. A single-light, moderate-priced fixture for commercial lighting by type C lamps. Well ventilated. The F. W. Wakefield Brass Company, Vermilion, O.

Moderate-priced chain pendant. Brass or steel chain made by automatic machinery. Entire unit substantially built of good materials. The F. W. Wakefield Brass Company, Vermilion, O.

INDUSTRY ACTIVITIES

Pass & Seymour, Incorporated, Solvay, N. Y., have issued revised list price sheets on weatherproof aluminum shell sockets.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued a four-page folder on the C-H magnetic gear shift for automobiles.

Leeds & Northrup Company, Philadelphia, Pa., has issued bulletin No. 250, on its new type R galvanometer, an inexpensive instrument of high sensitivity.

National Metal Molding Company, Pittsburgh, Pa., announces that its office in Buffalo, N. Y., during the absence of L. S. Montgomery, now on the Mexican border with Troop I, First Cavalry, New York National Guard, will be temporarily in charge of C. L. Corbin, who has been transferred from Pittsburgh.

Fairbanks-Morse Electrical Company, Indianapolis, Ind., will erect an addition to its plant in that city, according to an announcement made by E. G. Cox, secretary-treasurer of the company. The new building will be erected in the rear of the company's plant at Twenty-first Street and Northwestern Avenue and will cost $18,000.

Crocker-Wheeler Company, Ampere, N. J., announces that its San Francisco district office, W. K. Brown, district manager, has been removed from the Crossley Building, 619 Mission Street, to the ground floor of 87 New Montgomery Street. A large assortment of motors, generators and transformers will be carried in stock for the convenience of buyers of electrical equipment on the Pacific Coast.

Sterling Electric Company, Minneapolis, Minn., agents for the "Mola" electric washing machine, manufactured by the **Modern Laundry Machine Company,** of Kansas City, Mo., recently put on a special campaign and sold over 100 machines in less than 30 days. The latter company claims to be the only concern that makes an electric washing machine with a heavy copper cylinder tinned on both sides. This prevents the forming of verdigris.

Roller-Smith Company, 233 Broadway, New York City, announces that it is now represented in Denver, Colo., by the O. H. Davidson Equipment Company, Ideal Building. This company will handle Roller-Smith apparatus in Colorado, Wyoming, New Mexico, Utah and parts of the states of Montana, Idaho, Arizona, Texas and South Dakota. The O. H. Davidson Equipment Company, having specialized in the sale of apparatus, is well equipped to handle the Roller-Smith Company's various lines of instruments, meters and circuit-breakers.

Ivanhoe-Regent Works of General Electric Company, Cleveland, O., has issued a leaflet (No. 208) calling attention to important revisions in its line of metal reflectors listed in catalog No. 303. These revisions are chiefly in the nature of a reduction in the number of Ivanhoe metal reflectors. The company has found that on account of the continual development of new and improved reflectors which serve to meet both new conditions and also to meet more satisfactorily the former problems, there is comparatively small call for certain of the older types. As the 25, 40 and 60-watt lamps had practically the same physical dimensions, it was found that one size reflector answers for all of them; therefore, the 25 and 40-watt reflectors have been largely dropped from the list. These and similar changes are for the purpose of standardizing on those reflectors that have been found to give the best service for all-around use.

The Splitdorff Electrical Company of California has leased the entire two-story building at 1022 Geary Street, San Francisco, for a period of five years, and the ground floor of the building at 1028 Geary Street.

S. K. F. Ball Bearing Company, Hartford, Conn., has prepared a 64-page booklet entitled "Better Electric Motors," which treats of the application of ball bearings to electrical machinery. The booklet is well prepared and contains many illustrations. In describing the advantage of ball bearings, points are brought out on durability, compactness, comparative efficiency, simplicity, cleanliness, lubrication, etc. Applications to mining locomotives, dynamometers, machine tools, fans, flour and textile mill motors are illustrated and described. Several pages are devoted to a description of the application of S. K. F. ball bearings on motor-generator sets which provide low-voltage current for the control of electric locomotives used by the Chicago, Milwaukee & St. Paul Railroad.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently sold to the Montana Power Company complete electrical equipment for the operation of a hydroelectric station on the Missouri River at Holter, Mont. The equipment furnished includes four 12,000-kilovolt-ampere, three-phase, 60-cycle, 6,600-volt, 150-revolutions-per-minute vertical water-wheel generators; two 500-kilowatt, 250-volt, 450-revolutions-per-minute vertical water-wheel exciters; four 12,000-kilovolt-amperes, oil-insulated, water-cooled, three-phase, 60-cycle transformers, 107,000 volts high voltage, 6,600 volts low voltage, with a maximum continuous rating of 16,000 kilovolt-amperes; switching equipment for the entire station, including type GA circuit-breakers for 107,000-volt circuits, and type E-6 circuit-breakers for 6,600-volt circuits. Battery-charging motor-generator sets, air compressors, testing set, oil filter, and all other necessary adjuncts are included in this order. The Anaconda Copper Company, of Butte, Mont., has recently purchased a 1,215-horsepower Westinghouse synchronous motor which is to be used for compressor service in its Leonard mine.

L. B. Allen Company, Incorporated, 4517 North Lincoln Street, Chicago, Ill., manufacturer of various soldering compounds, is finding its new Allen soldering stick to be one of its most popular products. This is a soldering flux put up in the form of a round stick, six inches long and one inch in diameter, inclosed in an individual wooden box. It is very simple to use this since all that is required is merely to rub the stick on the joint to be soldered after it has been heated, which causes the solder to adhere firmly and make a perfect joint without in any way corroding the wire or its insulation. These soldering sticks are non-corrosive and very economical as well as convenient; they can be used down to the last particle and are conveniently carried about in the tool grip or pocket. The company has been specializing on the production of soldering fluxes for many years and also produces soldering paste in tin cans, liquid paste in tubes, soldering salts in bottles, and soldering liquid in cans or kegs. Another new product of the company is Allen aluminum flux which can be used with ordinary solder for joining aluminum wires, bars, etc. Tensile tests of such aluminum soldered joints have given the remarkable results of an average maximum of 9,640 pounds per square inch and the bars tested broke, not at the joint, but beyond it.

PERSONAL AND BIOGRAPHICAL

MR. N. C. DRAPER, manager of the Sioux Falls, S. D., division of the Northern States Power Company, was elected vice-president of the South Dakota Electric Power Association at its annual meeting.

MR. GEORGE P. FLADING has been appointed manager of the Trumbull Electric Manufacturing Company's office in New York City at 114 Liberty Street. Mr. Flading has been in the employ of the Trumbull company for the past nine years as one of its salesmen in the Eastern territory, and has a broad experience in marketing the company's lines and a wide acquaintance in the electrical fraternity.

MR. E. T. FOOTE, formerly of the New York office of the Cutler-Hammer Manufacturing Company, and at one time in the engineering department at its Milwaukee factory, has recently been placed in charge of the Boston office, located in the Columbian Life Building. Mr. Foote's experience in the engineering department and sales engineering work in New York fit him admirably for his new position.

MR. SAMUEL INSULL, president of the Commonwealth Edison Company, Chicago, Ill., has been elected chairman of the board of directors of the reorganized Chicago & Milwaukee Electric Railway Company, which hereafter will be known as the Chicago, North Shore & Milwaukee Railroad Company. MR. BRITTAN I. BUDD, of the Chicago Elevated Railways, was elected president and will have charge of the operation of the railroad.

MR. E. S. HAMBLIN, for four years manager of the Randolph & Holbrook Electric Light Company, has been chosen general manager of the Union Light & Power Company, Franklin, Mass., succeeding MR. PHILIP H. CLARKE, who was killed in an automobile accident August 10. During Mr. Hamblin's term of manager at Randolph the output of the plant has been doubled and its efficiency greatly increased.

MR. A. H. MEYER, of the Bryan-Marsh Division, National Lamp Works of the General Electric Company, Chicago, Ill., and MR. E. W. BOND, of the Kansas City office of the same company, are receiving the congratulations of their friends as each became the proud father of a baby girl on August 18. The simultaneous arrival of the two young ladies is an event of which the Bryan-Marsh organization is justly proud.

MR. ELMER DOVER, vice-president of H. M. Byllesby & Company, and president of the Northern Idaho & Montana Power Company and Oregon Power Company, located at Tacoma, Wash., announces the appointment of MR. B. H. CLINGERMAN as assistant to the vice-president in charge of Pacific Coast properties. Mr. Clingerman was formerly general superintendent of the Mobile (Alabama) Electric Company, and has been succeeded by MR. A. D. QUACKENBUSH.

MR. ARTHUR J. SWEET, formerly a member of the firm of Vaughn, Meyer & Sweet, consulting engineers, of Milwaukee, Wis., has withdrawn from that partnership and will conduct individually a consulting practice in steam, electrical and illuminating engineering, with offices in the Palace Theater Building, Milwaukee. Mr. Sweet was at one time commercial engineer of the Holophane Works of General Electric Company, and in that capacity did considerable research work in the field of illuminating engineering. Among other things, he conducted a research for the United States Government on postal-car lighting, made under the auspices of the Baltimore & Ohio Railroad Company. He also conducted a similar research on day-coach lighting for the Association of Railway Electrical Engineers,

A. J. Sweet.

made under the auspices of the Lake Shore & Michigan Southern Railway. In 1913 Mr. Sweet joined the previously established firm of Vaughn & Meyer in Milwaukee, and since then has devoted much of his time to designing the new system of street lighting for Milwaukee, which is now in course of construction. Mr. Sweet is a recognized authority on this subject and will continue to make a specialty of street-lighting installations. He is a member of the Illuminating Engineering Society and the author of numerous papers on illuminating-engineering problems.

MR. HERBERT A. DALLAS, clerk of the State Examiners of Electricians of Massachusetts, has been appointed industrial agent of the department of University Extension by the State Board of Education.

MR. J. P. TODD, who has been manager of the electric-light plant at Elizabethtown, Ky., since it has been owned by the Kentucky Utilities Company, has been promoted to the position of manager of the electric-light properties at Bowling Green, O. The change is effective at once. Mr. Todd has been succeeded at Elizabethtown by MR. DANIEL MORGAN.

MR. ROBERT MONTGOMERY, commercial manager of the Louisville (Ky.) Gas & Electric Company, who is also president of the Advertising Club of Louisville, has been selected as chairman of advertisers' day at the Louisville Rotary Club, which will be observed on September 7. Mr. Montgomery has made a big impression on Louisville business men with his aggressive advertising and selling policies, and the Rotarians are looking to him to explain just how it is done.

MR. EDWARD T. HUGHES, formerly contract agent of the Dubuque (Iowa) Electric Company, has been transferred to a similar position with the Northern Iowa Gas & Electric Company, of Humboldt, Iowa. Mr. Hughes became associated with the former company in 1913, coming from Muscatine, Iowa, where he was employed by the Citizen's Railway & Light Company. He is succeeded by MR. J. H. RILEY, of Joliet, Ill. The Northern Iowa Gas & Electric Company is controlled by Elston, Clifford & Company, of Chicago, Ill., who recently obtained control of the plant of the Dubuque Electric Company.

MR. FERDINAND W. ROEBLING, of John A. Roebling's Sons Company, in addition to being one of the leading manufacturers of the country, is a breeder of thoroughbred Guernsey cattle on his large farm near Trenton, N. J. He recently purchased some remarkably fine young cows and is at the present time the possessor of one of the highest bred herds in the country Mr. Roebling, who was a close friend of Homer D. Martin, the late very eminent painter of landscapes, is not only a patron of this art, owning several of his friend's best examples, but at times wields the brush himself with skill, and delights in painting sections of his herd amidst their scenic surroundings.

MR. R. A. LUNDQUIST, consulting engineer, of Minneapolis, Minn., who has been selected by the United States Bureau of Foreign and Domestic Commerce as a special agent to investigate the markets for electrical goods in China, India, Australia and South Africa, was graduated from the college of electrical engineering, University of Minnesota, in 1905. Following his graduation he was employed by prominent electrical supply houses until 1911, when he established his own business in Minneapolis, specializing in hydroelectric and transmission-line work. Mr. Lundquist is the author of "Transmission Line Construction—Methods and Costs," and has contributed numerous articles to the technical press. He is chairman of the Minnesota Section of the American Institute of Electrical Engineers.

OBITUARY.

MR. EMIL E. HERTER for almost 30 years Thomas A. Edison's chief mechanical engineer in the laboratories at West Orange, N. J., and who had worked on many of Edison's most important inventions, died August 23. He was 59 years old.

CURRENT ELECTRICAL NEWS

Weekly Record of Construction Activities

EASTERN STATES.

HAMMOND, N. Y.—The transfer of the local electric-lighting plant, owned by William Soper, to the Hammond Light & Power Company has been approved by the Public Service Commission. The exercise of a franchise granted to the company by the village of Hammond is also approved and the company is permitted to issue $10,000 of its common stock at par, the proceeds to be used for the acquisition of the Soper plant and for improvements and extensions to the system.

MONROE, N. Y.—The Orange & Rockland Electric Company, of this city, has been authorized by the Public Service Commission to issue $37,000 of its five-per-cent first and refunding mortgage bonds at 90, to net $33,300, or, instead, $33,000 of its seven-per-cent accumulative preferred stock, the proceeds will be used to reimburse the treasury for expenditures of capital in 1913 and 1914. The company is authorized to issue $25,000 of its seven-per-cent accumulative preferred stock at par to provide for extensions of its lines this year and in 1917.

NEWARK, N. J.—The Common Council has authorized an appropriation of $217,000 for lighting and electrical construction along city streets during the coming fiscal year.

NEWTON, N. J.—The Board of Education will receive bids until September 21 for electrical work at the public school. Plans are on file at the office of Rutherford Tuttle, district clerk.

ALLENTOWN, PA.—At a meeting of the Town Council, the borough engineers, Bascom and Sieger, presented an outline of plans for the establishment of a municipal electric-lighting plant.

CLAYSBURY, PA.—The Public Service Company, which will furnish electrical energy for power in Greenfield Township, Blair County, has been chartered with a capital of $5,000. Offices will be maintained in this city.

PHILADELPHIA, PA.—The Ferris Shoe Company will make extensions and alterations in its power plant on Janney Street.

PHILADELPHIA, PA.—The John Lang Paper Company will build a new boiler plant on Twenty-fourth Street, to cost about $20,000.

PHILADELPHIA, PA.—The E. G. Budd Manufacturing Company, manufacturer of automobile bodies, has had plans prepared for an electrical and mechanical plant to be installed in its new factory.

HICKORY GROVE, S. C.—J. S. and S. C. Wilkerson are interested in a plan to install an electric-lighting plant here.

SPARTANBURG, S. C.—The South Carolina Light, Power & Railway Company, of Spartanburg, has awarded to the J. G. White Engineering Corporation, 43 Exchange Place, New York City, a contract for the consulting engineering in connection with the design and erection of a concrete dam 600 feet long and 45 feet high, on the Broad River, near Gaston Shoals, approximately 30 miles from Spartanburg. This dam will be in connection with the company's hydroelectric development at Gaston Shoals. The South Carolina Light, Power & Railways Company does the entire street railway, electric-lighting and power business in this city. The power developed by the company's hydroelectric plant at Gaston Shoals is transmitted over 70 miles of line to Spartanburg, Gaffney, Cowpens, Woodruff, Pacolet and Blacksburg.

COMMERCE, GA.—At a recent election voters here approved the issuance of $10,000 in bonds, the proceeds to be used for the purchase of the electric distribution system of Harmoney Grove cotton mills.

APALACHICOLA, FLA.—The Apalachicola Electric Light & Telephone Company has been incorporated with J. F. C. Griggs, president, and will furnish service in this city.

ST. PETERSBURG, FLA.—The St. Petersburg Lighting Company will install machinery and undertake improvements to double the capacity of the electric-lighting plant.

NORTH CENTRAL STATES.

CLEVELAND, O.—The Winton Hotel Company, J. L. Free, president, will build a 550-room hotel at Ninth and Prospect Streets, to be known as the Hotel Winton. It will cost $1,200,000 and is to be completed by October, 1917. Wells Brothers Company, of Chicago, Ill., are the general contractors and N. M. Dunning, of Chicago, is the architect. The contract for electrical work will be placed in a short time.

CLEVELAND, O.—Organization of a large corporation to control street car lines and public service plants in Michigan, Eastern Ohio and Western Pennsylvania is indicated by efforts to sell the Northern Ohio Traction Company to eastern capitalists. It is reported that the Republic Power & Light Company, which controls the street-railway franchises in Warren, Niles, Youngstown, Sharon, Sharpsville and New Castle will be absorbed. The purchaser of the Northern Ohio Traction Company is said to be the Commonwealth Power, Railway & Light Company, of Michigan, which controls street-railway franchises and public utilities in Jackson, Kalamazoo, Flint, Manster, Saginaw, Bay City Grand Rapids, Cadillac and Battle Creek, Mich. and Springfield, O.

CLEVES, O.—A 15-year contract with the Union Gas & Electric Company, of Cincinnati, to furnish 50 80-candlepower street lamps at $20.50 each per year has been approved by the City Council. It is reported that Anderson and North Bend, O., will petition the company to extend its electrical service to those districts.

LIMA, O.—More than $75,000 is being expended here in an addition and new equipment in the Ohio Electric Railway power house, according to an announcement made by General Manager H. G. Gilpin.

INDIANAPOLIS, IND.—The Public Service Commission has received petitions asking authority for the Indiana Power & Water Company, with headquarters in Greene County, to buy five electric plants in Greene County and to issue $199,000 in stock and $945,000 in bonds. The petitions were filed by the companies to be sold. The sales contemplated are: Home Light & Power Company, Bloomfield, $67,000; Indiana Water & Light Company, Worthington, $35,000; Elnora Light & Power Company, Elnora, $5,000; Myers Light & Power Company, Odon, $18,000; Bicknell Light & Power Company Bicknell, $75,000. Through H. L. Clarke, president of the Indiana company, the Public Service Commission has been informed that the company intends to operate in various coal-mining counties of Indiana, and eventually intends to build light and power plants in such of the towns as offer a market for the service. The company's petition says the company was organized to supply light, heat, power and water in Greene, Owen, Sullivan, Martin, Daviess, Knox and Pike Counties.

HANOVER, IND.—The Kent Light & Power Company, of this city, has been incorporated with $3,000 capital stock by James C. Reed and others, and will establish a plant to serve Kent and other small towns in this section.

LAPORTE, IND.—Plans are being considered by H. E. Bucklin, of Chicago, for establishing interurban railway connections between Elkhart and Toledo, to be installed by May 1, 1917. A completion of such a line would mean the connection of Chicago and Toledo by electric railway lines.

BELLEVILLE, ILL.—Bids will be received this week by the Board of Local Improvements for the construction of an ornamental lighting system, consisting of 73 cast-iron ornamental lamp standards, steel taped cable, fuse blocks, switch boxes, wires, sockets, glass shades, electric lamps, tape, concrete bases and other material.

CLAYTON, ILL.—I. W. Fisk, of Champaign, is making a survey of the city for the purpose of furnishing an estimate of the cost of installing an electric-lighting plant.

PAWPAW, ILL.—The Illinois Northern Utilities Company has taken over the local electric-lighting plant and after the erection of a transmission line from Earlville will close the plant and supply energy from one of its larger stations. Construction of a transmission line from Tampico to Ohio and Walnut is being rushed by the company and as soon as it is completed the generating station at Ohio will be closed, service being supplied from the company's transmission lines.

GRAND RAPIDS, MICH.—The Michigan Railway Company, which controls the interurban lines between Grand Rapids and Kalamazoo, Battle Creek and Holland, is planning to erect a terminal station in Grand Rapids at Monroe Avenune and Lyons Street. H. H. Cromwell, of Grand Rapids, is president.

BRODHEAD, WIS.—The Water and Lighting Commission is considering plans for rebuilding the local power plant or erecting a new plant.

LAKE GENEVA, WIS.—The Wisconsin Railroad Commission has issued a permit to the Southern Wisconsin Electric Company, of this city, to issue $128,000 in bonds, the proceeds to be used in improving and extending the local electric light and power plant.

JACKSON, MINN.—Construction work will begin soon on an addition to the local electric light and power plant.

GLEN, MINN.—Electrically driven pumps will be installed in a local mine, of which A. V. Peterson is superintendent.

HILL CITY, MINN.—An electric-lighting system will be installed here. H. J. Scott is interested in the plans.

CLARINDA, IOWA.—The Lee Light & Power Company, of Clarinda, has been incorporated in West Virginia, Rufus E. Lee being secretary of the company. The capital stock is $633,000.

DANBERRY, IOWA.—The local electric-lighting plant was destroyed by fire last week, the loss being about $5,000. The plant will be rebuilt at once.

McGREGOR, IOWA.—The McGregor Electric Light & Power Company has nearly completed work on a high-tension transmission line from Monona to Postville, and service will be furnished to the latter town and intermediate points. It is reported that the Upper Iowa Power Company will erect an auxiliary plant at Postville to be used for emergency service.

PARNELL, MO.—The Maryville Electric Light & Power Company, of Maryville, Mo., has applied for a franchise to supply electric light and power here.

STANBERRY, MO.—The Mound City Electric Light & Ice Company has purchased the holdings of Stanberry Light & Power Company for a consideration of $35,000.

ST. JOSEPH, MO.—According to a statement by F. L. Hanush, chairman of the committee appointed by the Commerce Club, approximately $200,000 will be needed for improvements and extensions to the municipal electric-lighting plant to place it in an efficient and serviceable condition. The estimate calls for an expenditure of $85,000 for plant improvements, $15,000 for standards for the white-way system and $8,000 for about 275 new arc lamps. At the next election, voters here will consider the issuance of $85,000 in bonds, the proceeds to be used for lighting plant improvements. The issuance of additional bonds will be considered after a more extended investigation of the local plant conditions has been made.

ST. LOUIS, MO.—A permit has been granted to the Wintergarden Ice Company

for the construction of a two-story power plant at 5663 Kingsbury Boulevard. The plant will cost in the neighborhood of $12,000.

HOXIE, KANS.—Bonds have been voted for the establishment of an electric-lighting plant.

PLYMOUTH, NEB.—The Martz Engineering Company, 207 Orpheum Building, Lincoln, Neb., is preparing plans for an electric power plant and distribution system for this city.

SCOTIA, NEB.—Bids were received here this week for the construction of electric-lighting and water-works systems.

WENTWORTH, S. D.—The work of erecting a transmission line from Colman is progressing rapidly and electric service will be furnished in this city in the near future.

WORTHING, S. D.—The Town Council has granted to William F. Donahue, a local capitalist, a franchise to install and operate an electric-lighting system in Worthing. The franchise is for a period of 20 years. Construction of the plant will commence as soon as the material can be placed on the ground.

FARGO, N. D.—City Engineer F. L. Anders is preparing specifications for a whiteway system on Roberts Street.

MUNICH, N. D.—Ways and means are being considered by P. J. Anthony and others for establishing an electric-lighting plant here.

PAGE, N. D.—F. E. Davis has purchased the local electric-lighting plant formerly operated by W. J. Thompson.

STARKWEATHER, N. D.—The Northern Utilities Corporation has been organized with a capital of $25,000 by T. J. Daugherty, G. R. Jackson and J. Kurth.

WALHALLA, N. D.—The electric-lighting plant of the Walhalla Roller Mill Company was destroyed by fire. The total loss is estimated at $50,000, which is partially covered by insurance. Two dynamos and the switchboard were completely destroyed.

SOUTH CENTRAL STATES.

OWENSBORO, KY.—The Kentucky Electrical Company is adding equipment for the manufacture of an improved electric lamp for automobiles.

KNOXVILLE, TENN.—The John G. Duncan Company is in the market for a 20-horsepower, an 18-horsepower and a 15-horsepower motor.

MEMPHIS, TENN.—The G. W. Simmons Company is in the market for a 25 to 30-kilowatt alternating-current generator, direct or belt-connected to engine, with switchboard and accessories.

KENNER, LA.—A mass meeting was held in this city at which plans were laid for securing water and electric-lighting systems for the owners of property between Kenner and Suburban Acres. A. H. Johness is interested in the project.

BLACKWELL, OKLA.—On September 12 voters here will consider a proposition to grant a franchise to the Oklahoma Railway Company to construct and operate a street-railway system in this city. The City Council has also authorized the calling of an election at which citizens will vote on the question of issuing $35,000 in bonds, the proceeds to be used in extending the municipal electric-lighting and water systems.

CHICKASHA, OKLA.—The Chickasha Electric Light Company contemplates expending about $10,000 for improvements to its plant.

SHAWNEE, OKLA.—The Oklahoma Power & Light Company has been incorporated with a capital of $25,000 by Sinclair Mainland, Oshkosh, Wis.; J. A. Hamilton, Merissa, Ill., and Edward Howell of Shawnee.

DALLAS, TEX.—The Stone-Webster Engineering Corporation, of Boston, Mass., has been granted a renewal of its permit to do business in Texas. It has a capital stock of $500,000 and its Texas headquarters are at Dallas.

SAN ANTONIO, TEX.—The George West Water & Light Company, of George West, Live Oak County, has been incorporated with a capital of $40,000 by George W. West, S. S. Searcy and Charles Scheiner, Jr., all of this city. The company will construct an electric-lighting plant and waterworks system.

SAN ANGELO, TEX.—The Interstate Electric Corporation of New York has been granted a franchise by the City Commission for the construction of a street-railway system here.

DATES AHEAD.

Association of Edison Illuminating Companies. Annual convention, Hot Springs, Va., September 4-7. Secretary, G. C. Holberton, San Francisco, Cal.

Pennsylvania Electric Association. Annual convention, Eagles Mere, Pa., September 5-8. Secretary, H. M. Stine, 211 Locust Street, Harrisburg, Pa.

American Institute of Electrical Engineers. Pacific Coast convention, Seattle, Wash., September 5-8. Secretary, F. L. Hutchinson, 29 West Thirty-ninth Street, New York City.

Northwest Electric Light and Power Association. Annual convention, Hotel Washington, Seattle, Wash., September 6-9. Secretary, W. G. Letson, Jim Creek Water, Light & Power Company, Arlington, Wash.

Indiana Electric Light Association. Annual convention, Anthony Hotel, Fort Wayne, Ind., September 12-14. Secretary, Thomas Donohue, Lafayette, Ind.

Illuminating Engineering Society. Annual convention, Bellevue-Stratford Hotel, Philadelphia, Pa., September 18-20. Assistant secretary, C. D. Fawcett, 29 West Thirty-ninth Street, New York City.

Association of Iron and Steel Electrical Engineers. Annual convention, Chicago, Ill., September 18-22. Secretary, W. O. Oschmann, Oliver Steel & Foundry Company, Pittsburgh, Pa.

American Electrochemical Society. Semi-annual meeting, New York City, September 28-30. Secretary, J. W. Richards, South Bethlehem, Pa.

Electrical Supply Jobbers Association. Quarterly meeting, Hotel Statler, Cleveland, O., October 10-12. Secretary, Franklin Overbagh, 411 South Clinton Street, Chicago, Ill.

New England Section, N. E. L. A. Annual convention, Pittsfield, Mass., October 17-20. Secretary, O. A. Bursiel, 149 Tremont Street, Boston, Mass.

Jovian Order. Annual convention, Indianapolis, Ind., October 18-20. Secretary, Ell C. Bennett, Syndicate Trust Building, St. Louis, Mo.

Telephone Pioneers of America. Annual meeting, Atlanta, Ga., October 19-20. Secretary, R. H. Starrett, 195 Broadway, New York City.

SAN SABA, TEX.—The San Saba Electric Light Company contemplates making improvements costing about $10,000. The company plans to increase its capacity and furnish 24-hour service throughout the year.

WESTERN STATES.

MILESTONE, MONT.—The Town Council has taken steps toward the creation of two improvement districts and plans to issue bonds in the sum of $6,000 for the establishment of a municipal electric-lighting plant, to be operated in connection with the pumping station.

DENVER, COLO.—Property owners on California Street in the downtown district have raised money for illuminating that street between Fifteenth and Eighteenth Streets. The ornamental standards, which will be 14 feet high, are now being made. Eight will be placed to the block and each will be capped with a 750-candlepower nitrogen-filled lamp.

LAFAYETTE, COLO.—Contracts have been let and preliminary arrangements have been made for rebuilding and improving the power plant of the Western Light & Power Company in this city at a cost in excess of $50,000. This expenditure will not materially increase the capacity of the plant but will assure steady economical service. A cooling pond 100 by 150 feet is to be constructed of concrete to secure increased efficiency in the use of water for the condensers.

DOUGLAS, ARIZ.—A street-lighting system is under discussion by the City Council. Various types of poles are being considered.

TEMPE, ARIZ.—At a recent meeting of the City Council the question of a municipal electric-lighting plant was revived, and it is expected the town will install a plant of its own in the near future.

GRANTS PASS, ORE.—City Attorney H. D. Norton has filed action in the Circuit Court against the Rogue River Public Service Corporation for the forfeiture of the $1,000 bond given to guarantee the carrying out of the terms of its franchise. The franchise was for the construction of an electric light and power system within the city, two miles of transmission line to be erected by last April.

LAPINE, ORE.—Articles of incorporation have been filed for the Pringle Falls Electric Power Company of LaPine, by E. L. Clark, A. D. Lee and F. W. Thomas. The capitalization is $500,000.

SALEM, ORE.—Application to appropriate water from Multnomah and Peterson Creeks for power development purposes has been filed with State Engineer Lewis by Charles Coopey, of Portland. If the application is granted it is the intention to divert the water from above Multnomah Falls and return it to the creek above the falls. The cost of developing the power project is estimated at $20,000.

SILVERTON, ORE.—The Silver Falls Timber Company has just received 15,000 pounds of electric cable. The company is erecting a new power house.

FRESNO, CAL.—The County Supervisors have rejected all six bids recently received for installing the proposed electrolier lighting system in Court House Square. It was estimated that the work would not cost in excess of $9,500 and the lowest bid received was for $13,987.

FULLERTON, CAL.—Property owners have taken up the matter of securing ornamental street lights. In a petition to the City Council they recommended the use of single reinforced concrete lighting standards.

LONG BEACH, CAL.—The local manager of the Pacific Telephone & Telegraph Company has announced that improvements to the system in this city will be made shortly at a cost of about $28,000, including $20,600 for an aerial cable on Fifth Street between Orange and Fourth Streets.

LOS ANGELES, CAL.—The hydroelectric power plant of the Pacific Electric Railway at Uplands was destroyed by fire a few days ago, incurring a loss of about $20,000.

LOS ANGELES, CAL.—The Board of Supervisors rejected all bids recently received for lighting the Hall of Records and re-advertised for bids to be opened on September 11.

LOS ANGELES, CAL.—A petition asking for the establishment of a highway lighting district to be known as the Athens lighting district will be heard by the County Supervisors on September 11.

LOS ANGELES, CAL.—The City Council has ordered the necessary appliances installed and electrical energy furnished for one year for lighting Adams Street between Figueroa and Hoover Streets. Protests will be heard on September 6.

LOS ANGELES, CAL.—The property of the Escondido Utilities Company has been sold at auction for $10,000. A. W. Wohlford, of Escondido, holder of 49 out of 50 outstanding bonds of the company, was the purchaser. The property consists of a plant supplying the town of Escondido with gas and electricity. It was erected by a company organized about five years ago by Seth Hartley of Colton. The cost was about $30,000.

REDLANDS, CAL.—The Pacific Light & Power Company is expending about $15,000 in rebuilding and extending the company's lines crossing streams in San Bernardino and Riverside Counties.

SACRAMENTO, CAL.—The question of establishing a municipal electric-lighting plant is under consideration by city officials.

SAN FRANCISCO, CAL.—The Board of Public Works has awarded the contracts for the necessary machinery for the Cherry Creek power station that will be part of the Hetch-Hetchy water supply project. The General Electric Company has the contract for generators.

SAN LUIS OBISPO, CAL.—The Supervisors of San Luis Obispo County have called a special election to vote on the formation of the Margerita public highway lighting district.

WOODLAND, CAL.—The trustees of Reclamation District 1600 have awarded the contract for installing a large pumping plant to the Yuba Construction Company. The Westinghouse Electric & Manufacturing Company have the contract for furnishing two 250-horsepower motors, and the Pacific Gas & Electric Company will supply the power for a term of five years.

YREKA, CAL.—The California-Oregon Power Company will soon have completed the survey of the power extension between

Shasta Springs and McCloud, a distance of seven miles. Material is being distributed along the line for the building of the same. The same company is building an extension from Castella to Carville and Trinity Center, which will probably be completed within six weeks.

Proposals

TRANSFORMERS.—Bids will be received September 9 at Room 406, City Hall, Chicago, Ill., for furnishing four 400-kilovolt-ampere transformers to the pumping station at 2260 South Ashland Avenue. W. R. Moorhouse, Commissioner of Public Works.

MOTOR-DRIVEN AIR COMPRESSOR.—Sealed proposals will be received September 8 by the Board of Public Service, Youngstown, O., for furnishing one centrifugal air compressor, together with electric motor and all auxiliaries. D. J. Jones, clerk of the Board of Public Service.

AUTOTRANSFORMERS. — Sealed bids will be received September 9 at Room 406, City Hall, Chicago, Ill., for furnishing four 250-kilovolt-ampere autotransformers to the municipal power station, Twenty-fifth Street and California Avenue. W. R. Moorhouse, Commissioner of Public Works.

CONDUIT SYSTEM.—Sealed bids will be received by the South Park Commissioners, Fifty-Seventh Street and Cottage Grove Avenue, Chicago, Ill., September 15, for the construction of an underground conduit system for lighting Michigan Avenue from Twelfth Street to Garfield Boulevard. J. F. Neil, secretary.

ELECTRICAL SUPPLIES.—Sealed bids will be received by the Commissioner of Gas and Electricity, Room 614 City Hall, Chicago, Ill., until September 8, for furnishing electrical supplies in the following approximate quantities: 1,200 line insulators; 57,000 feet of weather-proof line wire, and 225 manhole frames and covers. W. G. Keith, Commissioner of Gas and Electricity.

ELECTRICAL SUPPLIES.—Bids will be received at the Bureau of Supplies and Accounts, United States Navy Department, Washington, D. C., for furnishing supplies at the following naval stations: Schedule 45, Brooklyn, N. Y., one 10-horsepower induction motor. Schedule 46, Washington, D. C., 50 0.25-horsepower, 120-volt, direct-current motors. Schedule 50, Norfolk, Va., one electric arc welding and cutting outfit. Schedule 59, Brooklyn, N. Y., miscellaneous single-conductor and twin-conductor wire. Schedule 68, Brooklyn, N. Y., five 120-volt, direct-current blowers. Schedule 70, Newport, R. I., one 10-kilowatt electrolytic generator. Schedule 71 and 75, Brooklyn, N. Y., miscellaneous radio transmitting sets. Schedule 72, Washington, D. C., miscellaneous antennas, masts, transmitting sets, generators, etc. Schedule 73, Washington, D. C., 31 radio wave meters. Schedule 74, Washington, D. C., 126 radio receivers. Bidders desiring to submit proposals should make application immediately for schedules to the Bureau, or to the purchasing office nearest to navy yard where delivery is to be made.

LIGHTING FIXTURES.—Sealed propostals will be opened in the office of the Supervising Architect, Treasury Department, Washington, D. C., at 3 p. m., September 13, 1916, for furnishing and installing lighting fixtures in the United States post office at Ashland, Ky., the United States post office at Batavia, N. Y., the United States post office at Elyria, O., the United States post office at Logan, O., the United States post office at Merril, Wis., the United States post office at Middletown, O., the United States post office and customhouse extension, etc., at Muskegon, Mich., the United States post office at Navasota, Tex., the United States post office at New Braunfels, Tex., the United States post office at Sidney, O., the United States post office and courthouse at Tulsa, Okla., and the United States post office at Washington, Iowa, in accordance with drawings and specifications, copies of which may be had at that office. Proposals are desired only from those qualified to produce work of the highest grade both artistically and mechanically, and the right is reserved to refuse to send the drawings and specifications to or to receive proposals from anyone who, in the opinion of the Supervising Architect, is not so qualified. Jas. A. Wetmore, Acting Supervising Architect.

Financial Notes

Consolidated Gas, Electric Light & Power Company of Baltimore has completed details of its new financial plan and it will be announced in the near future. The plan provides for the future financing of the company through the sale of common stock.

The Virginia Railway & Power Company report for the year ended June 30, 1916, shows an increase in gross earnings of $551,227. In the five years from 1911 to 1916 the gross earnings show an increase of $1,359,266 or 31 per cent, while the net earnings show a 27.3-per-cent increase.

The Public Service Corporation of New Jersey has issued a report showing increased gross earnings for July, 1916, of $383,795 over the corresponding month of last year. For the first seven months of the present year, ending July 31, the company's receipts have increased over 13 per cent, or about $2,800,000, over the same period of 1915. The increase in net surplus for July, 1916, is $90,172, and for the entire seven months' period $700,337.

The Oneonta (N. Y.) Light & Power Company has been authorized by the Public Service Commission to issue $52,800 of its common stock to pay for additions and betterments already made and to discharge certain proper obligations, and to issue $75,000 of its common stock, which is to be exchanged on a basis of par for a like amount of outstanding six-per-cent cumulative preferred stock, which preferred stock is to be returned to the treasury of the company.

The Wisconsin Railroad Commission has granted permission to the Sheboygan Electric Company, owned by the American Public Utilities Company, of Grand Rapids, Mich., to issue $200,000 in common stock, $350,000 in preferred stock, and $1,550,000 in bonds. The money is to be used to retire stock of the old Sheboygan Railway & Electric Company and for additions and extensions. Authority was also granted the Red Cedar Valley Electric Company, owned by the same company, to issue $140,000 in bonds and $10,000 in stock to retire the stock in the old company.

Dividends.

	Term	Rate	Payable
Ark. Val. Gas & Elec., pf.	Q	1.75%	Sept. 15
Blackstone Val. Gas & Elec.	Q	2 %	Sept. 1
Conn. Pw., pf.	Q	$1.50	Sept. 1
Con. Gas, Elec. Lt. & Pw., Balt., com.	Q	1.75%	Oct. 2
Con. Gas, Elec. Lt. & Pw., Balt., pf.	S	3 %	Oct. 2
Interstate Elec. Corp., pf.	Q	1.75%	Sept. 1
Montana Pw.	Q	1 %	Oct. 2
Montana Pw., pf.	Q	1.75%	Oct. 2
Twin City Rapid Transit, com.	Q	1.5 %	Oct. 2
Twin City Rapid Transit, pf.	Q	1.75%	Oct. 2

Reports of Earnings.

JACKSON LIGHT & TRACTION.

Jackson Light & Traction Company reported for the year ended June 30, 1916, as follows:

	1916	1915	Changes
Gross earnings	$288,043	$290,118	Dec. $2,075
Net after taxes	100,805	89,292	Inc. 11,513
Surplus after chgs.	56,315	43,807	Inc. 12,508

DAYTON POWER & LIGHT.

	1916	1915
July gross earnings	$116,896	$76,033
Operating expenses	75,095	41,711
Net earnings	41,801	34,322
Non-operating revenue	949	967
Total income	42,750	35,289
Interest on bonds	15,204	15,288
Other interest and sinking fund	4,458	2,835
Total deductions	19,662	18,123
Net income	23,088	17,166
Dividend on preferred stock	14,812	10,538
Surplus	8,276	6,628

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Aug. 28	Aug. 21
American Tel. & Tel. (New York)	131⅜	131¾
Commonwealth Edison (Chicago)	141	141
Edison Electric Illuminating (Boston)	237	237
Electric Storage Battery common (Philadelphia)	67½	67
Electric Storage Battery preferred (Philadelphia)	67½	67
General Electric (New York)	170½	170¼
Kings County Electric (New York)	130	—
Massachusetts Electric common (Boston)	7	7½
Massachusetts Electric preferred (Boston)	40½	42
National Carbon common (Chicago)	184½	181
National Carbon preferred (Chicago)	121½	121¾
New England Telephone (Boston)	126	127
Philadelphia Electric (Philadelphia)	28½	28⅜
Postal Telegraph and Cables common (New York)	85	—
Postal Telegraph and Cables preferred (New York)	67	—
Western Union (New York)	95½	96
Westinghouse common (New York)	59¾	60⅝
Westinghouse preferred (New York)	70	—

Electrical Patents Issued August 22, 1916

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,195,177. **Musical Instrument.** L. G. Bergeron, Lakewood, and R. B. Brewer, Cleveland, O. Details of solenoid-operated striker.

1,195,178. **Electrical System for Automobiles.** J. Bijur, assignor to Bijur Motor Lighting Co., New York, N. Y. Gearing of magnets and dynamo with engine.

1,195,180. **Vehicle Signal Apparatus.** B. L. Bobroff, Milwaukee, Wis. Direction indicator for automobiles.

1,195,193. **Sad-Iron.** A. Feyes, assignor to Pittsburgh Electrical Specialties Co., Pittsburgh, Pa. Has lamp mounted on it.

1,195,211. **Electrolytic Process for the Extraction of Cobalt Oxids.** K. S. Guiterman, New York, N. Y. For obtaining cobalt oxids from solution of a cobalt salt.

1,195,217. **Reinforced Battery Jar.** A. Hawthorne and J. H. George, Bridgeport, Conn. Jar of rubber-like material reinforced with fibrous textile.

1,195,230. **Lamp Guard.** O. Johnson, assignor to Flexible Steel Lacing Co., Chicago, Ill. Cage for incandescent lamp.

1,195,232. **Automatic Cutout for Electric Motors.** H. W. Kimes, asignor to Vaile-Kimes Co., Dayton, O. Governor for air compressors, etc.

1,195,234. **Coin-Registering Device for Telephones.** H. Kramer, New York, N. Y. Details of pay-station device.

1,195,239. **Electrical Display Apparatus.** A. Laszlo, Charlottenburg, Germany. Sign characters have spark gaps across which are high-potential discharges of frequency to appear as continuous illumination.

1,195,250. **Magnetic Coupling.** A. F. Milbrath, assignor to Wisconsin Motor Mfg. Co., Milwaukee, Wis. Adjustable gearing.

1,195,262. **Lamp-Supporting-Trolley Structure.** C. L. Pierce, assignor of one-half to Hubbard & Co., Pittsburgh, Pa. Details of boom and shifting rod along which trolley moves.

1,195,263. **Insulator Support.** C. L. Pierce, assignor of one-half to Hubbard & Co. Sheet-metal bracket and insulator thimble.

1,195,269. **Refrigerating Machine.** J. D. Ross, Seattle, Wash. Electromagnetically controlled.

1,195,275. **Coin Depositing and Recording Device.** J. L. Schmidt, Indianapolis, Ind. For slot machines; electrical control.

1,195,300. **Compass.** H. Wagner, Water-

loo, Wis. Magnetic element is one-piece steel ring and special mounting of index card.

1,195,319. Carrier. H. Wulbers, White, S. D. Electrically driven, for store service and the like.

1,195,355. Indicating Apparatus. C. Gustafson, St. Paul, Minn. Details of pawl and rachet mechanism operated by electromagnets.

1,195,361. Headlight. W. H. Kelso, Los Angeles, Cal. Arrangement of adjustable deflectors.

1,195,363. Handle Switch for Suction Cleaners. J. B. Kirbym, Cleveland, O. Switch casing forms handle tip and switch is operated by rotatable cap.

1,195,383. Automobile Headlight and Mounting Therefor. J. C. Moore, Connersville, Ind. Carried on radiator frame.

1,195,432. Sensitive Plate for Rontgen Photography and Process of Making the Same. H. Arnold, Charlottenburg, and M. Levy-Dorn, Berlin, Germany. Method of preparing highly sensitive plates impenetrable to rays.

1,195,444. System of Electrical Distribution. J. L. Creveling, assignor to Safety Car Lighting & Heating Co., Jersey City, N. J. Generator and battery system for car lighting.

1,195,449. Solenoid. C. S. DuBelle, Williamsport, Pa. Has special air-cushion structure for retarding plunger.

1,195,472. Cutout Switch. A. W. Houchin, Kirkwood, N. J. On field of dynamo and controlled by stray flux.

1,195,485. Space Telegraphy. C. V. Logwood and C. F. Elwell, Palo Alto, Cal. Details of transmitter employing continuous, undamped oscillations.

1,195,499. Automatic Fire-Alarm. G. B. Rattermann and A. W. Garrison, Birmingham, Ala. Employs telephonographic means.

1,195,506. Closed-Circuit Magnet. A. P. Sanborn and R. C. Wilson, Ossining, N. Y. Magnetic tripping mechanism including a permanent magnet for controlling semaphore signal for railways.

1,195,508. Combined Ampere and Volt Meter. A. Schoeller, Frankfort-on-the-main, Germany. Structural details of instrument of d'Arsonval type.

1,195,509. Apparatus for Dividing Couplings. R. Scholz, assignor to National Tube Co., Pittsburgh, Pa. Saving arrangement electrically driven.

1,195,526. Potential Starter. A. A. Stein, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Details of voltage-controlled switch mechanism.

1,195,534. Electrically Propelled and Controlled Railway System. G. P. Thurber, Pittsburgh, Pa. Block system having different characters of controlling and propulsion currents.

1,195,540. Motor Controller. R. P. Warner, assignor of one-half to C. C. Blankenburg, Kalamazoo, Mich. Adjustable mounting of brushes on end head.

1,195,574. Electrical Transmitting Device and Circuits Therefor. J. W. Frost, Washington, D. C. For transmitting distinctive signals.

1,195,579. Detector for Broken-Down Insulation. G. B. Gray, assignor to Automatic Train Control & Signal Co., Pittsburgh, Pa. Arrangement of circuits and insulated members on car truck.

1,195,583. Traffic Director. F. B. Henretta, Roanoke, Va. For intersecting streets; operates signals on the four corners.

1,195,589. Calling Device. W. Kaisling, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Impulse mechanism for telephone systems.

1,195,590. Telephone Switch-Hook. W. Kaisling, assignor to Kellogg Switchboard & Supply Co. Of formed sheet-metal.

1,195,600. Signalling System. F. P. McIntosh and E. F. Beaubien, assignors to Western Electric Co., New York, N. Y. For elevator cars.

1,195,601. Water Heater. J. Nathan, Los Angeles, Cal. Combined heater and plug for water bags.

1,195,607. Process of Securing Metal from Ores. J. H. Ried, Newark, N. J. Ore fed into arc between iron electrodes, then subjected to low melting point, metal immiscible with iron and having superior affinity for ore metal and ore metal recovered.

1,195,615. Electric Water-Heater. M. Silon, St. Louis, Mo. Resistance heater for insertion in pipe connection.

1,195,617. Process of Making a Leaching Solution for Extraction of Metals from their Ores. H. B. Slater, Los Angeles, Cal. Electrolytic treatment of ferrous chlorid and sodium chlorid.

1,195,619. Switch Lock. E. D. Smith, St. Louis, Mo. Mechanism actuated by removable key.

1,195,630. Magnetic Grip. E. H. Walsh, Chicago, Ill. For slotting machines, etc., magnets in bed plate have circuits controlled by tool drive.

1,195,632. Circuit Connections of Electron Discharge Apparatus. W. C. White, assignor to General Electric Co., Schenectady, N. Y. Potential independent of potential between cathode and anode is applied to cathode for heating purposes.

1,195,636. Electric Shade-Holder. L. W. Anderson, Waterbury, Conn. Separable socket cover has shade supporting portions.

1,195,642. Automobile Signalling Device. I. Bauer, Middleton, Conn. Direction indicator.

1,195,659. Illuminated Advertising Device. C. W. Court and A. V. Goldberg, Chicago, Ill. Rotary cap having spiral vanes producing rotation from rising heated air, surrounds lamp bulb.

1,195,660. Rheostat. H. L. Dodge, Iowa City, Iowa. Unitary device has resistance and switch arrangement for obtaining variable current or voltage at will.

1,195,677. Galvanic Cell. A. Heil, assignor of one-half to C. Hubert and one-half to S. Stern, New York, N. Y. Has depolarizer of hydrate of manganese, mercuric oxid and carbon.

1,195,700. Street-Railway Crossing. T. C. MacAllister, New York, N. Y. Arrangement of conductor rails for main and auxiliary shoes.

1,195,704. Electrolytic Process for Removing Oxid or Rust. O. Marino, London, England. Iron articles are made cathodes in aqueous bath containing phosphoric acid.

1,195,712. Electrical Measuring Instrument. C. E. Norton, Manchester, Conn. Details of indicator of d'Arsonval type.

1,195,723. Storage-Battery Locomotive. C. A. Pratt, assignor to Goodman Mfg. Co., Chicago, Ill. For use in mines.

1,195,728. Portable Electric Lamp. A. C. Recker, assignor to Waterbury Mfg. Co. Waterbury, Conn. Flashlight.

1,195,733. Apparatus for Producing Unidirectional Electric Currents of High Potential F. Rieber, Berkeley, Cal. For use on single-phase supply.

1,195,734. Signal Device. C. W. Riedel, Saginaw, Mich. Arrangement of mirrors and lamp sockets at end of arm; for automobiles.

1,195,748. Block System. R. C. Sutpjin, Corydon, Ky. Signal system for railways; arrangement of track circuits.

1,195,754. Annunciator. W. L. Weber, Chicago, Ill. For use in restaurants in communicating with kitchen.

1,195,768. Combined Reversing Switch and Brushholder for Dynamo-Electric Machines. C. Bergmann, assignor to Knapp Electric & Novelty Co., New York, N. Y. Structural details.

1,195,771. Automatic Telephone-Exchange System. G. A. Betulander, S. Villastad and N. G. Palmgren, assignor to Betulander Automatic Telephone Co., London, England. Manner of grouping and selecting outgoing and intermediate junction lines.

1,195,776. Take-Up Device For Line Wires. E. E. Burnham, Amite, La. Structural details.

1,195,778. Panelboard Fitting. T. W. Byrne and R. C. Lehane, assignors to Bryant Electric Co., Bridgeport, Conn. Structure of insulating cover plate.

1,195,785. Device for Rewinding Films. H. B. Cunningham, St. Paul, Minn. Motor circuit controlled by door of casing.

1,195,790. Oil Fuse. L. W. Downs and A. W. Faxon, Providence, R. I., said Faxon assignor to D. & W. Fuse Co., Providence, R. I. Fuse and terminals on upper portion from which suspended oil tank is removable.

1,195,805. Electric-Light Fixture. R. S. Giese, Pittsburgh, Pa. Has semi-indirect lighting bowl and shower lights.

1,195,813. Branch Box for Electric Conductors. M. Havens, Jr., Albany, N. Y., and S. B. Van Raust, assignor to Crouse-Hinds Co., Syracuse, N. Y. Details of conduit outlet box adapted to support fixture canopy.

1,195,828. Electric-Heating Elements. L. R. McClatchie, assignor to Moffat Stove Co., Weston, Ontario, Canada. Helical resistor coil laid in grooves in slab of insulation.

1,195,829. Change-Making Machine. C. McDermott, Freehold, N. J. Electromagnetically controlled.

1,195,837. Vehicle Signal. F. R. Moore, Chicago, Ill. Automobile direction-indicator.

1,195,850. Trolley. J. A. Paige, assignor to W. F. Mooers, Milton, Mass. Mounting and structure of harp.

1,195,861. Manufacture and Construction of Commutators. E. F. Smith, assignor to Neil Smith Electric Tool Co., Cincinnati, O. Blank having segments partially cut apart has slots filled with insulation and then separation of segments completed.

1,195,891. Semi-Automatic Telephone-Exchange System. W. Aitken and R. Aitken, London, England. Manner of interconnecting exchanges.

1,195,892. Electrically Operated Switch. D. R. Allen, North Augusta, S. C. Structural details of railway track switch.

1,195,900. Train Bulletin. S. W. Balch, Montclair, N. J. For use in stations for announcing arrival, location, etc., of trains.

1,195,912. Fraud Detector. W. L. Cummings and L. W. Blanchard, Leavenworth, Kans. Employs ultra-violet rays for testing object to discover flaws.

1,195,916. Trolley Guide. H. J. Dauben, Columbus, and O. L. Stump, Marion, O. Structure of frog.

1,195,921. Magneto Frame. W. E. Dow, Braintree, Mass. Special detailed construction.

1,195,924. Separator for Storage-Battery Plates. W. S. Gould, New York, N. Y. Has perforated hard-rubber sheet against positive plate and wood sheet against negative.

1,195,925. Portable Electric-Lighting Apparatus. H. H. Hirsch, Philadelphia, Pa. Details of battery lamp structure and connections.

1,195,928. Electric Riveter. W. Morava, Chicago, Ill. Details of driving gear.

PATENTS EXPIRED.

The following United States electrical patents expired on August 29, 1916:

631,768. Electric Motor. J. Anderson, St. Louis, Mo.

631,769. Electric Hammer. J. Anderson, St. Louis, Mo.

631,786. Space Block for Laminated Armatures, H. Geisenhoner, Schenectady, N. Y.

631,791. Electric Switch. J. W. Hearn, New York, N. Y.

631,796. Storage Battery. H. H. Kneper, Chicago, Ill.

631,810. Separator for Accumulator Plates. H. G. Osburn, Chicago, Ill.

631,816. Electric Arc-Lamp. G. C. Pyle, Indianapolis, Ind.

631,839. Process of Manufacturing White Lead or Other Pigments by Electrolysis. H. C. Woltereck, New York.

631,854. Trolley-Pole Retriever. D. E. Lesser, Warren, Pa.

631,864. Coupling for Electric or Other Wires. R. Thompson, Passaic, N. J.

631,869. Signal Mechanism. G. B. Gray, Crafton, Pa.

631,871. Electrical Measuring Instrument. E. W. Jewell, Chicago, Ill.

631,888. Electric Gas-Lighting Apparatus. W. E. Cram, Boston, Mass.

631,892. Electric Push-Button. L. F. Johnson, Easton, Pa.

631,917. Signaling and Controlling Apparatus for Motor-Vehicles. W. R. Wynne, London, England.

631,919. Electric Motor. R. Arno, Turin, Italy.

631,959. Electric Heater. E. E. Gold, New York, N. Y.

631,965. Electric Arc-Lamp. M. S. Okun, New York, N. Y.

631,970. Electric Terminal. F. Schwedtmann, St. Louis, Mo.

631,975. Means for Operating Electric Arc Lamps. H. A. Wagner and D. W. Roper, St. Louis, Mo.

632,004. Electrical Warp Stop Motion. W. H. Baker, Central Falls, R. I., and F. E. Kip, Montclair, N. J.

632,019. Controlling System for Electric Motors. F. A. Merrick, Johnstown, Pa.

632,033. Trolley. C. L. Weyand, New York, N. Y.

632,039. Automatic Controlling System for Electromotive Devices. J. B. Blood, Newburyport, and F. A. Merrick, Newton, Mass.

632,046. Telegraph Register. E. B. Ellicott and L. E. Oehring, Chicago, Ill.

632,052. Switch for Trolley Wires. A. F. Humphrey, Alleghany, Pa.

632,058. Incandescent Electric-Light Blub. R. Mossgrave, Jr., Steubenville, O.

632,066. Telephone-Exchange System. C. E. Scribner, Chicago, Ill.

632,067. Multiple-Switchboard System. C. E. Schribner, Chicago, Ill.

632,076. Electric Switch. A. E. Wells, Pittsfield, Mass.

632,089. Automobile Torpedo. T. E. Barrow, Mansfield, O.

632,106. Visual Signal Apparatus. R. Einbigler, New York, N. Y.

632,144. Electric Meter. A. Peloux Geneva, Switzerland.

632,145. Time Switch. H. S. Prentiss, Elizabeth, N. J.

632,211. Electric-Conductor Support. J. M. Anderson, Boston, Mass.